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INDUSTRIES

RUBBER

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"Those who have seen the 'Peeps at Many Lands' series from the same publishers will welcome these books, which ought to become quite as popular. They will give 'general knowledge' in non-technical language by those who have first-hand experience of the matters upon which they write. If they succeed in casting such a spell upon the reader as this book before us, as it throws a world of interest into the realties of sugar-cane and sugar-beet growing, sugar-making and refining processes, they will be read through at a sitting."—*Western Morning News.*

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"Miss Browne's book . . . is so clearly written, so understandable by the individual of average intelligence, that there is no longer any excuse for ignorance. Every confectioner should read it. Its educational value cannot be too highly praised."—*The Confectioners' Union.*

"British Guiana and the West Indies are particularly indebted to the author for her beautiful and accurate descriptions."—*Barbadoes Advocate.*

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SMOKING WILD RUBBER ON A PADDLE IN THE BRAZILIAN FOREST. *Page* 26

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PEEPS AT INDUSTRIES

RUBBER

BY

EDITH A. BROWNE

CONTAINING

TWENTY-FOUR PAGES OF ILLUSTRATIONS
FROM PHOTOGRAPHS

UNIV. OF CALIFORNIA
SOUTHERN BRANCH

LONDON
ADAM AND CHARLES BLACK
1912

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NOTE

It is astonishing how ignorant is the world as a whole of the great industries which maintain our oft-boasted civilization, and it is ignorance of this character which this series of books aims to dispel.

Produced on the same lines as the "Peeps at Many Lands" series, which has met with such remarkable success, these books will bring the reader into a complete understanding of all the great industries of the British Empire and the world at large. Technicalities being avoided, there are no impedimenta in the way of easy assimilation of the story and the romance of great manufactures. The reader is taken into the atmosphere and confronted with the stern realities of each industry, and when he has laid down the book he will find he has another window in his house to let in the sunshine of knowledge.

The reception accorded to the first volume, on sugar, has encouraged the belief that there is a wide sphere of usefulness, and power of pleasure-giving, for a series of Peeps at Industries written from first-hand knowledge. This, the second volume, is devoted to the rubber industry, and is similarly a collection of experience, observation, information, and pictures harvested "on the spot." The next book in the series will deal with tea.

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RUBBER

CHAPTER I

THE ROMANCE OF RUBBER

THERE is a wish that has so taken possession of us that it is beginning to make our hearts ache. Happily, we are living in the everything-is-possible days of Once Upon a Time. Directly that wish begins seriously to worry us, Mother Witch realizes that here is a case in which her services are needed, and forthwith she hurries to our midst to see what she can do to make us happy and content.

"Carry us away on your broomstick," we beg, "to some new land, where we can see people using something which we know nothing whatever about at present, but which will one day bring to pass a great revolution throughout the whole wide world."

Says Mother Witch:

"You civilized mortals have yet so many lands to discover, so much to learn from the folk who dwell therein. I could take you to many a strange country where you would see the mere savage turning the simplest of Nature's gifts to marvellous account. Some day more extraordinary uses will be found for these same things by the only kind of people you think clever. But when that day dawns, such things will soon

become common, and their power of usefulness will quickly come to be taken as a matter of course. In this way is all wonder being banished from the earth by the civilization you're so pleased to call wise. But I'm not here to preach to you. Come, I will take you to a country where everything is yet as Dame Nature made it. It is a country full of possibilities, abounding in natural wonders whose discovery may create many and many a mighty change in the everyday life of the world at large. More than this, I will promise you nothing. You shall see what you see. Let us away."

We are whisked across the sea. At length we are hovering over a seemingly boundless forest, which appears to defy even a single ray of light to pry into its secrets. As we get nearer to the treetops, we notice that parts of the country beneath us are open to the sky. A river, inset with islands and sandbanks, completely severs the forest ; a goodly number of streams fight their way into it on either side, now boiling with rage as their passage is interfered with by a stubborn array of rocks, now dashing headlong over a sheer precipice, now corkscrewing a long way round to avoid impenetrable barriers ; and, in addition to the breaches made in the forest fortress by these waters, there are patches of grassland openly rejoicing in the sun. Mother Witch assures us that in parts of its course the chief river is five, ten, or even as much as fifteen miles wide ; that the sandbanks and islands we see in it are of enormous size ; that the patches of grassland cover acres and acres of ground. Of course, she knows what she is talking about, so, in accepting her word about the size of the openings, we are better able to realize

the immensity of the mass. For, in a bird's-eye view, all the features of a landscape are seen in proportion ; and as we look from aloft at this country we have come to visit, the outstanding feature is a wilderness which Nature designed as a citadel wherein she could reign supreme, and which, since the days of the Great Beginning of all things, she has fortified against any human desire to interfere with her own imagination and power of achievement.

We drop to earth in this country, landing in the heart of the forest. Now there is no trace of an outlet to be seen. Surely we are prisoners—but which of us, at this moment, would care to escape, even were we shown a way ? In the wildest revels of dreamland we have never beheld anything so luxuriously beautiful as the scene of reality which now surrounds us. Multitudes of giant trees burst the bonds of thickly tangled undergrowth, only to be fettered again up to their very summits, a hundred feet or more above our heads, by the endless twistings and turnings of gnarled vines and stout-stemmed creepers. Clinging to the trees are choice orchids, weird in form and fantastic of colour ; the dense undergrowth of browns and greens is thickly patterned with brilliant blooms ; from the rich overgrowth hang vivid-hued floral streamers and festoons ; gaily plumed birds are roosting amidst deepest shadows ; bright blue butterflies are holding carnival in odd spots, whither stray rays of the blazing sun have been able to penetrate through chinks in the leaf-thatched, flower-strewn vault.

Evidently there are people living within these forest confines ; for see, a tawny form is breaking through the bush. Come, let us hide quickly.

"This naked savage might be a cannibal!"

Possibly, but not for that reason alone have we slipped into a nook where we can watch him without risk of being discovered. Primitive man is frequently more shy than dangerous; if this aboriginal caught sight of us, perchance he would quickly plunge out of sight.

"Why does he go about with a parrot perched on his right forefinger?"

The bird is his favourite pet, and master and parrot like to be together as much as do you and your dog.

"Why does he carry that very long bit of cane? And he doesn't seem to have a bow with him, so of what use are those arrows in that pouch which is strung round his waist?"

The long cane is a very simple weapon called a "blow-pipe"; the arrows are the missiles for it. Whenever yon savage sees anything he wants to kill, he loads his pipe, puts it to his lips, blows, and out flies an arrow with terrific force and deadly aim.

Maybe this son of the wilds is out on a hunting jaunt on behalf of his tribe. Just as likely he is taking a walk; for quite possibly he has been suffering of late from an attack of wander-thirst—a common complaint among barbarians, to whom freedom is one of the most blessed possessions in life—so he has left the camp to roam it off. Weeks, months even, may elapse before he returns to his fellows. Meanwhile, he can easily supply all his wants, for he can shoot his meat, trap his fish, and gather an abundance of tasty and nutritious nuts and roots. Also, he can amuse himself by making a fine collection of pretty seeds and gay

feathers, wherewith to adorn himself on the next festival occasion at the camp.

Like all his fellows, he is an enterprising savage in that he is constantly on the lookout for forest products which can be turned to account in everyday life. See him now stopping to try the sap of a certain tree. With a flint axehead he probes the bark, when out oozes a thick white fluid, some of which drops on his hand. He rubs thumb against fingers to get it off, whereupon it gets thicker and thicker, and finally breaks loose as a bit of something solid. He experiments with this strange gift of the forest, and finds that it will stretch and rebound. He collects more of the sap, catching it this time in the palm of one hand. Into this liquid he drops the first little pellet he made, and proceeds to roll it round and round therein with his free hand. Soon the freshly collected sap begins to solidify on the pellet, and his treasure grows appreciably bigger. We watch this interesting experiment repeated time after time. The pellet has grown into a fair-sized ball; suddenly that ball slips from the grasp of the man who is so intelligently playing at work. Surely it is bewitched; for the moment it touches the ground, it tries to jump into the air. Why, if only he had known what was going to happen, if only he had stooped down a second earlier, he might have caught it before it again fell to earth. No wonder he looks pleased; he has discovered a new product that can be made into a plaything. He notes the kind of tree which has supplied him with the material for his highly amusing toy; then he picks up his blowpipe, calls his parrot back to its travelling perch, and goes his way.

Yes, certainly we will follow this interesting discoverer, but first we must ask Mother Witch to borrow for us some of those magic cloaks which render the wearer invisible ; for, as I have told you, were yon son of the wilds to see us, one way or another our adventures might be brought to an untimely end.

CHAPTER II

THE ROMANCE OF RUBBER—*continued*

Our leader seems to be pursuing a haphazard course as we shadow him about the forest. Nevertheless, it is not many months ago since he wandered this same way, and only a few weeks have gone by since a little party of the tribe rebeat with their footsteps this path, which was originally designed and cleared by remote ancestors as a cut to a good fishing stream. But fresh vegetation springs up with mushroom growth in this land of tropical luxuriance, and to-day the trail has been wellnigh hidden from view by a new tangle of undergrowth. There is no fear, however, of our leader losing himself in the maze ; he has the tribal instinct for finding his way through the forest ; the scenery, which seems to us so hopelessly bewildering, reveals to his trained eye many a signpost, and the thickest covering of shrubs, creepers, fallen leaves, broken branches, and storm-strewn trees cannot lead him astray from a path which he has roamed again and again ever since he was quite a little boy. Although he seems to be forcing a passage at random, he is following a trail which is as familiar to him as are the highways

and byways of our native town to us, and sooner or later, according as the fancy takes him to go the long way round, or turn aside into a short cut, he will get back to the camp.

Whatever may have been his purpose when he started out on his wanderings, clearly his chief desire now is to find trees of the same kind as that from which he obtained the strange material that he has made into a ball. Sometimes he comes upon two or three within a hundred yards or so of each other ; sometimes he has to walk a good mile from his last find before he espies another of the forest giants for which he is seeking.

After a few hours' diligent search, he walks ahead without stopping to test the sap of any more trees, and at length we realize that during the last hour he has been making straight for the camp. The moment he arrives here he shows his quaint toy to his fellows. The tribe are all very interested in it, very delighted with it, and it is tossed from hand to hand. The chief questions him, and there follows a conclave, at which it is decided that a party shall set forth on the morrow to collect more of the newly discovered material.

At dawn we leave the camp clearing, and once more plunge into the thick of the bush. With what a novel procession we join company and once more strike the trail ! Evidently it is not the custom to wear clothes in this part of the world, but personal ornaments seem to be in high favour. Nearly everyone is bedecked with some " pretty " knick-knack, such as a necklet of tiger's teeth, a jingling girdle of seeds, or a plaited-fibre armlet ; and the majority seem to make " pin-cushions " of their chin and lips—the fishbones you see sticking out therefrom are pegs on which they

hang decorations of feathers and seeds when they are merrymaking.

From the way these primitive folk set about getting a supply of the newly discovered product, we soon realize that they have more intelligence than we had previously given the savage credit for possessing ; for when the discoverer points out to his companions a specimen of the tree which yields the desired gum, a member of the party proceeds to carry out an experiment that would seem to be of both a practical and imaginative nature. A hole is scratched in the ground at the base of the tree, and a few inches above, in a straight line with this, several notches are hacked in the trunk. The sap, which immediately begins to ooze out, trickles down into the hollow beneath. You see at once that a more wholesale method of collecting has been devised than that of catching driblets of the sap by hand. But in the plan which is now being tried there lurks still more intelligence, inspiration, reason, instinct, or whatever you like to call it. For at the conclave in the camp, general opinion favoured the idea that heat was the agent which transformed the liquid into a solid. And if the warmth of a man's hand could bring about such a remarkable change, surely, it is argued, the heat of the sun would more readily have the same effect. So the sap is now to be left in the collecting hole, where it will come under the influence of baking hot tropical earth and thirsty tropical air.

Sap is still issuing from the wounded trunk when the party go off in search of other specimens of the tree. After a few hours, we find that they have been steering a course which brings them back to the first tree on which they operated. No wonder they are all so



LANDOLPHIA STEMS. *Page* 38

Young stems showing foliage and fruit

From a photograph in the East Africa Section of the Imperial Institute, by permission

pleased when they arrive at this goal, for they can see at a glance that their experiment has proved successful. True, the sap has now ceased to flow, but it is more than likely that some fresh wounds would produce a further supply. And sufficient for the moment is the joy of finding in the hole beneath the tree a big lump of solid something, like the material of the toy which their guide made yesterday. It is scooped out of its semicircular mould, is found to be still soft enough to work, and is quickly rounded by hand into the form of a ball.

* * * * *

Many years have passed since this new kind of gum was discovered ; but we are still living in the days of Once Upon a Time when we pay our second visit to the country where flourishes the tree of supply. In the interval since our first visit, the aborigines have had no communication with the civilized world. Yet they have contrived to make their new material serve more purposes than the original one of providing them with playthings. They have found out that it is waterproof, so they now smear it over pouches for holding treasures which they want to protect against a tropical downpour. And see the mere savage discovering a new use for this product which is destined to put the whole civilized world under a debt of gratitude to him. He rubs a thick coating of the sap over his feet—and lo and behold ! when it has dried and he wriggles his feet free, he is the proud possessor of the first pair of galoshes ever made.

CHAPTER III

THE HISTORY OF RUBBER

Of course, you have already guessed that the material used by the "poor savages" I have been talking about was rubber. But I should not be at all surprised if you are thinking that I have made up the whole story I have told you about the discovery of the product.

For the moment, I will neither confess nor deny that I have spun you a fairy story. Instead, I will ask you to give your attention to a few well-known facts about the history of rubber.

On the authority of an old and honoured historian, Herrera by name, Columbus saw the natives of the Island of Haïti, in the West Indies, playing with balls which were said to be made of gum from a tree. This was during his second voyage of discovery, in 1493 to 1496. A sixteenth-century document refers to elastic balls which the aborigines of the New World used in their games. And early in the seventeenth century a report was issued dealing with a tree growing in Mexico, from which the natives extracted a milky liquid that came to be used by the Spaniards for the purpose of making their garments water-tight.

In each case, the historical reference is generally admitted to concern the material we now call rubber. Therefore, by the way, so far as history enlightens us, Columbus was the first European to become acquainted with this forest product.

According to history, then, the aborigines in different parts of Southern America discovered rubber, and made use of it, without any help from the civilized world.



TAPPING A RUBBER-VINE, BELGIAN CONGO. *Page* 39

By the way, they called the material "*cahucu*." When an English scientist, by name Priestley, discovered in the latter part of the eighteenth century that cahucu would rub out pencil marks, this wonderful product was named *india-rubber*, in plain English. In nearly every other country it is now spoken of as *caoutchouc*.

Now, to come back to that story I told you "out of my head." As regards the time in which the events occurred I have already proved to you that rubber was discovered before Columbus discovered America; and as there is no authority which permits me to be more definite on this point, I think you will agree with me that I was bound to give the period of my narrative as Once Upon a Time. The scene of that story is, I now frankly admit, laid in Brazil—to be more exact, in the Valley of the River Amazon.

Here, you will surely ask what explanation I have to offer for selecting Brazil as the home of the great discovery—why not Haïti, since the first mention of rubber in history is connected with this island? Or why not Mexico, since the natives of this country are also credited by history with being amongst the earliest folk to make themselves acquainted with the uses of rubber?

I am quite ready to reply to such very natural questions. Just as no one can deny that the discovery of rubber has brought about a great revolution in the industrial world, so no one who knows the whole history of that revolution can dispute the fact that it was the discovery of Brazilian rubber which has been far and away the most powerful agent in effecting it. And although history does not give me a cut-and-dried date to support my belief that the aborigines of Brazil

collected rubber sap, and made use thereof as early as, or even earlier than, did the natives of Haïti and Mexico, it supplies me with facts which uphold this theory.

The Portuguese founded the colony of Brazil early in the sixteenth century, but naturally their first settlements were on the coast. About a hundred years later they began to explore the Amazon. The first European pioneer to journey along this wonderful waterway was a Portuguese missionary, and it is said that he was the first civilized man to see the natives of Brazil making use of rubber. Be this as it may, it is certain that the natives had long been acquainted with the product when the Portuguese began to colonize the Amazon Valley, for the settlers found that the aborigines of the district were skilled in making not only balls for playthings, but such useful articles as water-tight shoes and bags out of the sap of a tree that flourished in this locality.

It is not at all likely that the natives of Brazil had received any help from the natives of Haïti or Mexico in the matter of discovering that tree and the peculiar value of its sap. For the aborigines of Southern America are not given to wandering off to foreign lands either on business or pleasure, and even in these days it is only the very enthusiastic traveller or the man whose living depends on the rubber industry who undertakes a journey into the interior of Brazil, where, for the most part, the means of communication are still very primitive.

So far, I have shown you there is little doubt that the aborigines of Brazil discovered the rubber in their own country ; and I think I have given you sufficient evidence for asking you to believe that the discovery was

made off their own bat, and at quite as early a period as the natives of Haïti and of Mexico separately and independently discovered the rubber-trees in their own homelands.

I will now give you some further proofs that there is more truth than fiction in the story I told you.

Come with me into the Brazilian forests this very day. The scenery, you find, is so wildly beautiful that words cannot possibly do it justice, much less exaggerate its delights; in spite of the coming of the European, and the annual invasion by hundreds of rubber gatherers, few changes have been made in the name of Progress within these forests; so in the days before the white man knew of their existence they must have looked very much the same as they do now. And the pure-bred Brazilian native has not been entirely wiped off the face of his homeland. You may still come across some of the aborigines, and they still scorn clothes, adorn themselves with feathers and beads, carry a blowpipe, hunt their meat, and trap their fish.

As we start off along a track that has little or no more claim to be called a path than had the Indian trail in my story, I point out to you a specimen of the rubber-yielding tree that is a native of these forests. Very soon you notice for yourselves that there are numbers of these trees in the district. Were you a son of these wilds, wholly dependent on your surroundings for anything and everything in the way of supplies, would you not try to find out whether this tree cannot be made to provide you with something to eat or drink or play with?

Take out your penknife, and cut into the bark of one

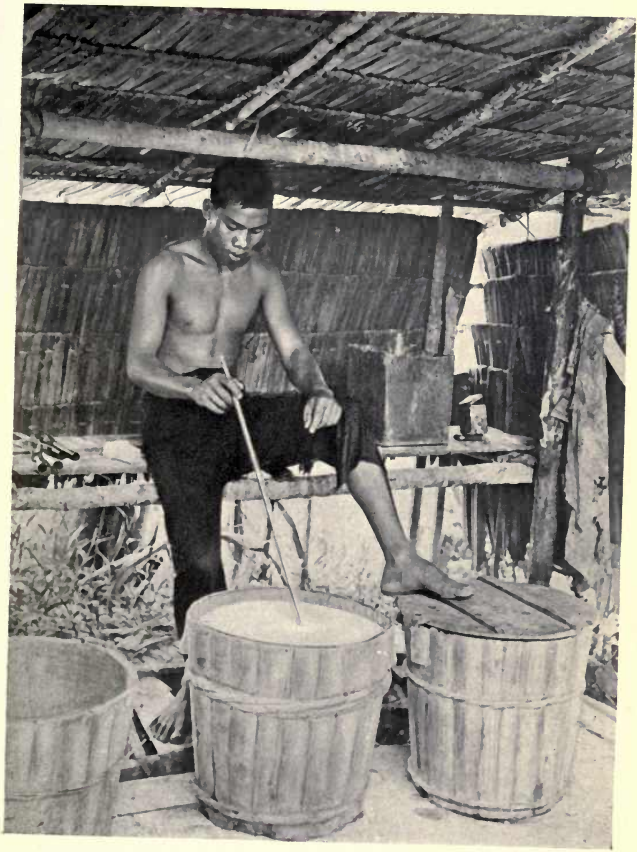
of these trees. Out oozes a thickish white substance, some of which drops on to your fingers. Without a moment's thought or hesitation, it comes natural to you to rub thumb against sticky fingers, whereupon the substance gradually solidifies, and at last breaks loose in the form of a tiny pellet. In a similarly simple way the mere savage discovered rubber hundreds of years ago ; only he used a flint axehead, or maybe a sharp tooth of some animal, instead of a penknife.

With regard to the method of collecting rubber by scraping a hole in the earth, and leaving the sap which trickled down into it to be dried by the natural heat of the earth and the air, I can only assure you that the white man found the aborigines " making " raw rubber in this way, so they must have invented the plan themselves.

To defend my choice of Brazil as the scene of my story, I must now justify my statement that the discovery of rubber in this country has been of more importance than similar discoveries in the forests of other lands.

The native rubber-tree of Brazil, botanically known as *Hevea brasiliensis*, yields the finest quality rubber. This specially good material is called " Para rubber," after the port of Para, at the mouth of the Amazon, which was the first centre of distribution.

The whole flourishing rubber industry of to-day owes its origin to the trade which sprang up in Para rubber, following on the colonization of the Amazon Valley by the Portuguese. During the first half of the eighteenth century Lisbon began to import rubber goods, such as hats, boots, bags, and capes, from Brazil, and in 1759 the Government of Para sent a suit of



Malaysian Rubber Co.

NATIVE COAGULATING JELUTONG. *Page* 41

rubber clothes as a present to the King of Portugal. In the early part of the eighteenth century, too, France began to take an interest in rubber, and it was not long before other countries, including England, began to experiment with the new material.

Until well on in the nineteenth century, rubber goods were made in Brazil only. The chief market for them was North America, which imported a varied assortment of such things as rubber shoes, tobacco-pouches, travelling bags, powder-flasks, and water-bottles. Amongst all these articles, the waterproof shoes did most to popularize the new material; the first shipment was sent to Boston in 1820, and these found such favour with the Americans that a couple of years later the United States imported another 500 pairs. So quickly was this second stock sold out that the States began to think an opportunity had arisen for them to make a new outlet for their manufacturing energy and enterprise, and very soon they decided to import raw rubber and manufacture rubber goods. About the same time, some pioneer rubber-goods factories were erected on the Continent.

The factory soon began to rival the forest workshop in the variety of goods turned out, and in such details of craftsmanship as style and finish. But the new enterprise did not prove very satisfactory, because it was found that these goods did not wear well. Evidently they suffered from exposure to the air, being damaged by changes of temperature.

This great drawback to manufactured rubber goods was removed by the discovery of a method of treating rubber with sulphur. The process, called "vulcanization," was discovered by an American named Charles

Goodyear, who made his first successful experiments in 1839. He himself did much to improve his method of making rubber more durable, and he also worked up this product into a material similar to horn ; but it was left for another inventive genius to find out how to polish that material and give us the very useful form of rubber which we call " vulcanite."

The discovery of the vulcanization process acted as a very great stimulus to the rubber industry. More and more keen and widespread became the desire to manufacture rubber goods, and the growing demand for the raw material led Brazil to extend her search for Hevea trees, and to set about dealing with the export of raw rubber in a more business-like way. Up to about 1877 the forests around the mouth of the Amazon had been the only source of supply. Now some of the upper tributaries of the river were exploited, and the glowing reports as to the wealth of Hevea in the inland forests led to a rush of rubber-gatherers into the interior. It soon became known that these reports had not exaggerated the available supply of Para rubber, and fresh energy and enterprise were attracted to the Valley of the Amazon by the rosy prospects of the raw rubber trade.

" How has that trade prospered ?"

The Amazon District (Brazil, Bolivia, and Peru) now has numerous competitors who cater for the world's annual consumption of between 70,000 and 80,000 tons of raw rubber. Although some of these competitors are countries which have very extensive rubber forests, although striking success has resulted from the many efforts to develop them, the Amazon Valley still controls the rubber industry, because it

(1)



(2)



(1) TAPPING RUBBER-VINE (FICUS). *Page* 40

(2) EXTRACTING GUTTA-PERCHA, GERMAN NEW GUINEA (KAISER WILHELMSLAND). *Page* 42

Photos taken by the Rubber and Gutta-Percha Expedition of the Kolonial-Wirtschaftliches Komitee, Berlin, to German New Guinea

exports such a large proportion of the world's whole supply of the raw material, and the quality of its output is far superior to that of the supplies from nearly every other rubber-producing country.

But here, I ought just to tell you that, for the first time in its triumphant career, wild Para has a really fearsome rival. This adversary is commonly known as Plantation Rubber ; as a matter of fact, it is Cultivated Para, which is making such a determined fight for supremacy in the raw rubber market. This is indeed a case of child rising up against parent, for the Cultivated Para is all being obtained from trees that owe their existence to seeds taken from the Brazilian forests. The struggle is causing much disturbance in the Rubber World ; all of you must have heard of at least one of the stirring events to which it has already given rise—the Rubber Boom in the spring of 1910.

CHAPTER IV

WE VISIT A SERINGAL

We want to see for ourselves the way the present-day rubber-gatherers in Brazil do their work, and the kind of life they lead. So we have made a long journey by boat up one of the tributaries of the River Amazon to the landing-stage for a typical rubber-gatherers' village.

We step ashore straight into the forest, and are warmly welcomed by a group of working men, who inquire eagerly for the latest news from anywhere,

about anything. For days we have been travelling in a region that is far removed from the busy haunts of man, and we have grown quite used to the solitude of the wilds; but the loneliness comes home to us much more forcibly as we realize that there are civilized folk who spend nearly all their life in these out-of-the-way parts.

We set out to walk along a rough road that threads its way through the jungle. Before long we notice buildings ahead. We are close upon a "seringal"—that is to say, a village which serves as the head-quarters of a number of rubber-gatherers, who work a big area of neighbouring forest-lands.

The seringal, together with the stretch of country which it serves, belongs to a man who probably lives far away in one of the two great commercial centres of Brazil—Para, at the mouth of the Amazon; or Manaos, about a thousand miles up the river. The owner may have inherited his claim to proprietorship, or he may have bought it from some other man; in any case, the tract of forest which is now regarded as his private property originally became one man's land because in days gone by some settler tried to make a living out of rubber collecting, went so far this way, so far that in his search for rubber-trees, and gradually came to look upon the district between such self-appointed boundaries as his own personal hunting-ground.

Great care has to be taken in choosing the site for a seringal. Since none of the forests have yet been opened up for more than about a mile in the inland direction, the seringals must all be built near the riverside; it is very necessary that they should be perched on some piece of rising ground, because the

waters of the Amazon rise very high at times, causing great floods.

The seringal we have come to visit is typical of the many widely scattered villages which the rubber industry has called into existence in the Brazilian forests of the Amazon—typical in its isolation, and as regards the style of its buildings, the kind of people who make up the population, and the everyday life of the little community, who are cut off from the rest of the world. The outstanding buildings are the manager's house, which boasts a tiled roof, his office and store. These are to all intents and purposes "government" quarters; for, although the manager represents a private individual, he rules the community who work for his master with much the same sort of authority he might be expected to exercise if he held office under the Republic. Round about his quarters are some thatched shanties, which provide accommodation for part of the community. But some of the labourers have to go their daily round from tree to tree in far distant parts of the forest; where their work is, there must they make their home in a solitary hut. The merriest day of the week for everybody is Saturday, when all the rubber-gatherers have to make their way to the manager's quarters, to hand over the rubber they have collected and to buy stores for the coming week. This general meeting, called together by business, is taken full advantage of as an opportunity for gossip, hospitality, and various little jollifications, such as a "sing-song."

The population of a seringal consists of working-class Brazilians, who are of Portuguese and mixed Portuguese and Indian descent. Certainly they look a

rough lot, but that is not surprising, seeing what a hard life they lead — and there are many rough diamonds among them. You will feel more in sympathy with them when you have lived but a day in their midst, and been with one of them on his round. But already you must have been thinking that they have not much comfort to look forward to when their work is done, for you can see at a glance that their houses are mere shelters.

Here is the picture you will take away in your mind's eye of a rubber-gatherer's home on the shores of the Amazon : A framework of poles, uprights and cross-bars, carries a thatched roof. The building is open on all sides—indeed, the only other detail which entitles it to the name of building is one floor, raised well above the ground, so that the inmates of the house can keep a little distance out of damp's way. The unpartitioned space between floor and roof serves as common day-room and night-room. Hammocks provide sleeping accommodation ; old boxes take the place of tables and chairs ; pots and pans pretend to be ornaments ; every corner is a makeshift cupboard for tinned foods, bottles, oil-cans, tools, and such-like oddments ; and the framework of poles does duty as wardrobe on week-days and as linen-line for the washing on Sundays.

In seringal life a married man and his family generally occupy a private hut. The unmarried men, and their married comrades who have not brought wife and children into the forest, live together in batches, several of them sharing one house on the " chummery " system.

CHAPTER V

WE GO WITH A SERINGUEIRO ON HIS ROUND

A RUBBER-GATHERER in the Amazon region is called a "seringueiro." On his daily round he has to follow a narrow path, called an "estrada," that has been cut through the forest as a means of communication from one scattered rubber-tree to another.

As I should like you to understand exactly how these estradas are planned, I want you to imagine, for the moment, that you are standing somewhere near the river in a tract of unexplored forest. From this spot as starting-point you set out in any direction you like to hunt for rubber-trees. However excited you may be, you cannot possibly hurry, as the only path at your service is the one you are making for yourself. You cut a narrow strip, the length of your arm's reach, out of the dense undergrowth, walk on a few paces, and are again brought to a standstill ; not another step can you move forward until you have continued the path by cutting away another strip out of the tangle ahead.

You know you are in a district where Hevea rubber-trees flourish, but you have to take your chance of finding them among the many kinds of trees that are crowded together in the forest. When once you have settled the general direction in which you will explore, you go straight ahead, for you are just as likely to find what you want in a direct line as you would be if you let the fancy of every few minutes lead you into clearing a more irregular, and therefore longer, path.

Of course, if you spot a rubber-tree a little way to the right or to the left, you bend your path round to meet it. When you have linked up about fifty Heveas, you curve your path so as to turn your face to the starting-point, and make your way back there, locating rubber-trees as you go along in the same way as on the outward journey ; so by the time you get back to the spot you set out from, you have cut an estrada that is roughly elliptical in shape, and you have linked up from 100 to 120 Heveas. They are fine, sturdy old trees, too, for the most part. Some are 60, 70, or even 80 feet high, and their circumference is anything from 3 to 12 feet in the lower regions.

When you have made one estrada, you can set out in a different direction from the same starting-point and clear another. Again and again you can repeat the same method of exploration, and you can loop up side estradas with the main ones. To complete your preparations for obtaining rubber, you must build a hut near the spot where all the main paths start and meet again, and arrange for labourers to come and take up their abode in it and work for you.

To-day we are not going to cut estradas. We have come to a part of the forest which is already looped with several such paths, and we are now standing outside the hut where live the seringueiros who work them. The time is about four in the morning, but, early as it is, the labourers are getting ready for the business of the day ; they are now collecting their tools, and hurriedly swallowing the coffee they put to boil whilst they were slipping into their few clothes.

We are joined by the seringueiro who is going to take us with him on his round. He is wearing a

battered felt wideawake, a cotton shirt open at the neck, and an old pair of trousers that are tied round his ankles with string ; his feet are bare. He carries a small axe, called a "machadinha," and a big collection of small tin cups. When he gets to the first rubber-tree on his beat, he deals it several blows with his axe, making a girdle of cuts at a height which is conveniently within his reach. This operation is known as "tapping," or "bleeding." Sap immediately begins to trickle from the wounds he has made in the tree, so under each cut he has to hang one of his collecting-cups. These are fastened to the tree by means of a bit of tin on the rim, which he bends over into the bark. Some seringueiros use clay cups, which they affix to the trees with a dab of moist clay.

Evidently this tree we are standing by has often been operated upon, for it has a wide belt of scars. Some of them look as if they were the marks of very severe wounds ; the gashes have healed under a new skin of bark, but in such a way that the surrounding surface of the trunk is very uneven with furrows and swellings. This disfigured appearance is a sign that the tree has been roughly treated by previous rubber-gatherers. However, if it had been as badly used by the early generations of seringueiros as were some of the Heveas, it would not now be here to tell us any tales about the reckless way in which tapping used to be done in Brazil and neighbouring countries. So little did the rubber-gatherers of the past care about the future welfare of the rubber industry of the Amazon that they often used to fell the valuable Heveas and hack them to pieces, sacrificing the source of a continuous milk-supply to their greed for getting as much rubber as

possible at the moment, and with as little trouble as possible. Some time ago masters began to see that they could not afford to let their men be so wasteful; if the Hevea-trees were destroyed in the more accessible parts of the forest, which had only been opened up at much expense and under great difficulties, the hunting-grounds would have to be extended farther inland, at far greater expense and under much greater difficulties. Nowadays, owing to the growing popularity of Plantation Rubber, there is a strong feeling that tapping methods should be further improved. Brazil and the neighbouring rubber countries have wakened up to the necessity not only of safeguarding their Hevea-trees against total destruction, but of protecting them against the injuries caused by unskilled operations. Many experiments are being made with a view to producing a less clumsy tool than the machadinha, and the very hard task has been taken in hand of trying to persuade a large but widely scattered army of rough men to work more carefully.

In tapping a rubber-tree, the cut must only go deep enough to open the cells which harbour the sap—which, by the way, in simple English is called "milk," and in technical language "latex." These cells are in the bark, extending from just beneath its surface to the cambium, or true outer skin of the wood. If the tapping tool pierces the wood, the tree gets maimed for life. Henceforth its supply of milk will be more difficult to get at, for when the wounds are sufficiently healed for the tree again to be tapped in the same region, the trunk will be knotted and furrowed in the way you have already seen. Consequently the milk-cells will be situated at different levels, instead of being



BALATA BLEEDERS LEAVING SPROSTONS' STELLING AT ROCKSTONE, BRITISH GUIANA. *Page* 46

Note large number of calabashes for catching the gum

evenly distributed beneath a covering of smooth-faced bark, and ceasing on the same level. Moreover, bad tapping makes the milk-supply poorer in both quantity and quality. And when a tree is very badly wounded in the wood it will very probably cease to give any milk at all.

While we have been talking about tapping in general, we have been following our Brazilian friend along his estrada, watching him deal with one tree after another in the same way as he treated the first one on his round. After a long walk, we get back to that first tree. The seringueiro now makes for his hut, puts away his axe, and picks up an old tin can. Once more he starts off on the same round, and now, as he goes from tree to tree, he unhooks the cups and pours their contents into the larger collecting vessel. The milk has stopped running, but the trees have yielded well this morning, and by the time the "milkman" is nearing home again he has to carry the can very steadily so as not to spill any of the morning's supply.

It is nearly ten o'clock when we follow our leader into his hut once more, and as we have had nothing to eat since we started out at four, no wonder we do full justice to the meal he invites us to share with him, and tell ourselves that dried beef and beans make very good fare. We might think differently if we had breakfasted on this, or very similar fare, every day for months past, and were not likely to get anything very different at any meal for months to come.

CHAPTER VI

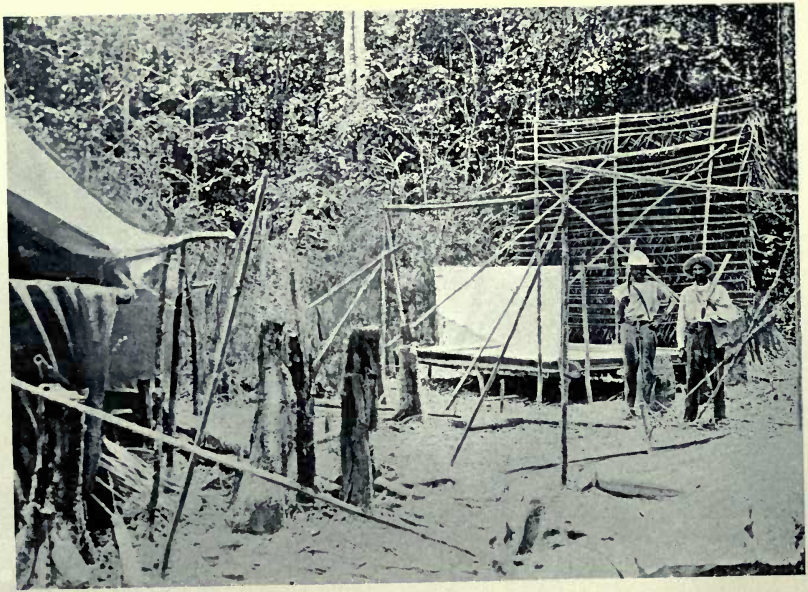
MAKING PARA RUBBER IN THE FOREST

After breakfast, the seringueiro sets about transforming the morning's "milk" into solid rubber—in technical language, he submits the liquid to a treatment whereby it is coagulated.

He makes up a big fire with palm-nuts, which burn splendidly, as they are very rich in oil, and which give off a thick smoke. It is with this smoke that he is going to dry and cure his rubber, and as he wants it to be very dense and heavily laden with the essence of the fuel, over the fire he puts a funnel, which acts as a chimney, and draws up the smoke in a compressed cloud.

He now takes a paddle-shaped piece of wood, and rolls a layer of freshly-made rubber round the blade. Then he holds the paddle over the funnel, revolving the blade in the smoke until the covering of rubber is thoroughly dry. Next, he dips the blade into the new "milk," and again holds it in the smoke until the sticky liquid solidifies as a coating round the foundation layer of rubber. Again and again he plunges the paddle into the "milk" and holds it in the smoke, until he has a large ball of rubber made up of layer upon layer of the material. This is cut through and the paddle removed; the rubber is then ready to go to market, and will perform the first stage of its journey thither on Saturday, when it is taken by the seringueiro to the manager's store.

Extra large balls of rubber, or "pelles," are made in



A BALATA BLEEDERS' CAMP. *Page 47*

From a photograph in the British Guiana Section of the Imperial Institute, by permission

a very similar way on poles. But instead of the poles being held by hand over the smoke, they are balanced on a roughly-made rest. A couple of pronged sticks are driven into the ground to serve as props for a horizontal bar. In the middle of this bar, which is just another bit of timber, is a noose of bush-rope. The pelle is made on the middle part of a separate pole. One end of this pole is slipped through the noose until the coating of rubber in the centre is well over the smoke; the other end is supported by hand, with or without the assistance of another noose of bush-rope hanging from the roof. The seringueiro turns the pole round and round, always keeping it in such a position that the growing ball of rubber, which he frequently feeds with milk, is twirled about in the smoke.

You are wondering, I expect, how the seringueiros get paid. They are all run by men of capital, called "aviadores." The aviador lives at one of the commercial centres of the Amazon rubber industry, such as Para or Manaos in Brazil. His business is to arrange for labourers to go up into the rubber districts, to supply them with anything and everything they want in the way of stores and outfit, and, if necessary, to advance them the money for their journey. His busiest time is in the early part of the year, because all new hands start off for the forests about March or April. They can then reach the scene of their labours towards the middle of May, when the rubber-gathering season begins.

All the labourers start off in debt to some aviador. When they reach the seringal which is their particular destination, the manager there instals them in one of

the huts, and tells them which estrada or estradas they are to work. Often one man is given two estradas, which are to be worked on alternate days, so that the trees can have a little longer rest between milking-times.

The first job everyone has to do is to lend a hand in clearing the estradas—and very hard work this is. Although the paths are old cuttings, they are blocked with a tangle of undergrowth. They have not been used since last December, when the Amazon, as usual, began its big annual rise, and overflowed its banks with a far-reaching volume of water. Since then the forests have been impassable, therefore work has been impossible until this month of May, when the lands are once more uncovered ; meanwhile, tropical vegetation has sprung up and run riot along the paths.

When the estradas have been re-cleared—also some new ones may be cut, if sufficient labourers have come up to make further development possible—tapping begins. You have seen how the serengueiro gets the rubber and prepares it for market. When he delivers his week's collection to the manager, the weight thereof is put to his credit, and his pelles are forwarded to the aviador who has sent him up to the seringal. The aviador sells them, and remits to the seringueiro the amount they fetch, less commission and something on account of his debt. All the rubber-gatherers take part of their dues in stores, as the aviador is general provider to the seringal.

You want to know what the seringueiros do when the flood season sets in ? Some of them go away to look for work in more civilized parts of the country. But many of them are several weeks' journey away from

any town, or from any part of the country where farming is possible. It would not be worth their while to go so far away and spend a lot of money on looking for work of a different kind, when the chances are so much on the side of their being compelled to return to rubber-gathering as the only means of earning a living. So they stop up in the flooded forests, living in the shanties which are perched on the highest stilts. They get through the long time from December to May as best they can, doing a great deal of smoking, sleeping, and idle gossiping. Sometimes they drink too much, and sometimes they fight—you expected as much? Well, although you have only had a peep at the kind of life these men lead, I am sure you have seen enough to make you slow to judge them harshly.

CHAPTER VII

DIFFERENT KINDS OF WILD RUBBER

MANY varieties of the same species of tree belong to the family which is known as "the Heveas," and several of them are rubber-givers. All rubber obtained from trees of this family has the distinctive name of "Para" in the commercial world. Three qualities of wild Para are sent to market—fine, entrefine or medium, and coarse or negro-head.

Fine Para is best quality rubber made from the richest kinds of Hevea milk. It is cured through and through, whilst the latex is being coagulated, with the smoke of palm-nuts. The nuts most commonly used in the Amazon region are the fruit of the urucuri palm,

which flourishes in the forests where the Heveas are found. Various products are turned to account as fuel for curing rubber in other parts of the world, but the results, taken as a whole, have led to a general opinion that the smoke of the palm-nuts used in the Amazon country plays an important part in keeping the rubber of this region first of all rubbers as regards quality ; but the secret of this smoke's special power has not yet been discovered.

Entrefine or medium Para is made from Hevea milk other than the very richest ; or it may be the result of best quality milk which has only been indifferently well cured.

Coarse Para, or negro-heads, is uncured or partly cured refuse. When a tree has been tapped, some of the milk in the collecting-cups cakes into a thin crust on the inside of the bowls, and drops fall and congeal on the rim and outer surface. The scraps have to be cleaned off the cups every morning, for new milk loses much of its value if it is allowed to come into contact with dirt or refuse ; sometimes they are thrown away, but frequently they are hoarded in a bag which the seringueiro takes with him on his tapping round for this particular purpose. The refuse is well worth saving, for it will fetch quite a good price as negro-heads. But such coarse rubber is not always an extra source of income to the seringueiro. Sometimes he loses considerably by it, for he finds himself, through no fault of his own, with nothing but this poor quality material as the reward for his day's toil. If it rains hard whilst the trees are being tapped, the latex curdles in the collecting-cups, and the seringueiro has to collect a supply of negro-heads instead of fresh



TAPPING BALATA. *Page* 48

From a photograph in the British Guiana Section of the Imperial Institute, by permission

milk. Again, the milk sometimes coagulates much too quickly when it is being cured ; the material produced is then negro-heads instead of fine or even medium Para.

In the commercial world Para rubber has many secondary names, which tell from which particular district such or such a supply has been obtained. The chief rubber-producing regions in the Amazon country are :

1. The Brazilian State of Para, in the Lower Amazon Valley, including the islands in the mouth of the river. One very good quality rubber from this region is called "Caviana," after the island of that name, where it is obtained.

2. The Brazilian State of Amazonas, in the Upper Amazon Valley. Rubber produced in this State is known generally as "up-river" rubber ; it is also called "Manaos," after the great commercial centre of the industry in this region, or "Madeira," after a tributary of that name which gives access to some of the richest rubber lands in the State.

3. Acre. This is a far interior territory, bordering on Peru and Bolivia. Acre, which is now federated with Brazil, is very famous for its rubber, which, like that of Amazonas, is generally known as "up-river" rubber.

4. The Brazilian State of Matto Grosso, in the Upper Amazon Valley. At present very little of this vast forest-land between Amazonas and Paraguay has been opened up, but, judging by what has already been seen of its dense jungle, the whole State is a treasure-ground of rubber-trees. Most of the rubber now exported from this district is coarse, and sun-cured

instead of smoke-cured. It, too, is called " up-river " rubber.

5 and 6. Bolivia and Peru. Both countries export large quantities of rubber, much of which is of excellent quality. The various grades of Bolivian and Peruvian Para are classed collectively as " up-river " rubber ; but the different qualities have native names as well, and these are quite popular as trade terms.

The Amazon country furnishes a rubber that is quite distinct from the Para material. It is called " Caucho," and is obtained from a tree known as the *Castilloa Ulei*. The biggest exporters are Peru and Bolivia.

There is no system of estradas to simplify the work of the caucho-gatherers. A search-party, largely composed of Indians, sets out to hunt for castilloa-trees in parts of the forest that have never before been explored. There is not so much as a track to help them on their journey, nor a clue of any kind to tell them in which direction to cut their way. In order to collect enough caucho to make a success of their trip they will probably have to travel several hundred miles ; quite likely they will lose themselves, and have to wander about for months before they happen to strike the right direction towards some isolated village. All their baggage has to be carried by hand or on the back, so only the barest necessities are taken. A large share of each man's burden consists of provisions ; even so, the stores are scanty enough, seeing that no one knows for how long they will have to be eked out, with the help of any game that may be shot.

Every castilloa-tree that is found is felled to the ground, and is then ringed with cuts, which extend the whole length of the trunk, at intervals of about 2 feet.



C. H. Kerr & Co., Kandy, Ceylon

RUBBER AND TEA ESTATE IN CEYLON. *Page* 65

The milk which runs out from these cuts is caught in little bowls. These are either fashioned from leaves, which are folded and sewn together, or they are made from seed-pods—in which case they are called "calabashes"—in the very simple way that you can easily make a cocoanut-shell do duty for a basin or a cup.

The contents of the bowls are poured into a hole in the ground or a scooped-out hollow in the trunk of a fallen tree, and the milk is coagulated with the help of soap, lime, or potash. After a few days the lumps of caucho are pressed together into square blocks, the market name for which is "Peruvian Slab."

Some of the milk sticks in the cuts and becomes coagulated through exposure to the air. About a fortnight after a tree has been felled the congealed caucho is picked out of the wounds. It comes away in stringlike strips, which are wound into balls. Some of these caucho balls are very roughly made; others are put together in a most pleasing way—the narrow golden strips are prettily interlaced the while they are being wound into a compact, round bundle; in its finished state the ball looks as if it had been fashioned from strips of bamboo by the patient, skilful hands of a Japanese toymaker.

CHAPTER VIII

DIFFERENT KINDS OF WILD RUBBER—*continued*

BEYOND the Amazon Valley, the chief wild-rubber producing countries in the New World are Central America and Mexico. Both are homelands of the

Castilloa, and Mexico has large areas of a rubber-giving shrub called "Guayule."

Now that you have seen how caucho is collected in South America, you will, I feel sure, be all the more interested to get a peep at some caucho-gatherers in Central America, who work in a different way. So let us go to Nicaragua.

Once more we are standing in the maze of a tropical forest. Just in front of us is a tree, which has big leaves hanging independently of each other from either side of the branches. By the shape and arrangement of its foliage we recognize it as a Castilloa. Under this tree stands a semi-clad, brown figure. What a dwarf he looks! No wonder; the tree with whose height you are unconsciously comparing his stature is a giant, whose top-to-root measure is well over 100 feet.

The native is going to collect caucho-milk. He does not cut down the tree, but taps it as it stands. With a big knife he makes V-shaped cuts in the trunk, operating on the lower part from the ground, and on the upper part from a hanging ladder. This rough-looking climbing apparatus he has made for himself out of bush-rope. You can see for yourself that it is easy enough for him to find bush-rope in this forest; from the branches of numbers of the trees around hang lengths of naturally-corded fibre, some of it string-like, much of it thicker than any rope that is ever made in a factory.

The caucho-milk runs out from the cuts and trickles down the trunk into a calabash. When the collector has tapped several trees, he puts all the milk into an old pan, and adds to it some watery juice which he has obtained from a particular variety of creeper. He

then stirs the mixture, and in a little time the rubber coagulates into lumps, which float on the surface. He takes these pieces of rubber out of the pan, and kneads them into flat, round "biscuits."

Our next visit is to Mexico. Here we will not go into the forests, among the caucho-gatherers; for time is pressing, and rather than look at similar sights to those with which we are already acquainted, we choose to make for a part of this country where we can watch, amidst quite new surroundings, a novel process of obtaining rubber from a plant which is quite different from any we can see elsewhere.

We are on the stony soil of a Mexican plain, standing knee-deep in scrub. As far as the eye can reach in every direction the ground is covered with dwarfish vegetation, which consists of a shrub called "guayule."

Guayule covers acres upon acres of the Mexican plains. It contains a large amount of rubber, which is secreted by all the plant-cells. Unlike most rubber-giving vegetation, this shrub does not yield its riches in the form of milk; the milk naturally coagulates within the cells and forms tiny particles of rubber. Presently you will see how these particles are routed out of their hiding-place.

In the district we have come to visit, several Mexicans are busy gathering in a harvest of guayule. As you watch them at work, you notice that they pull up some of the shrubs by the roots, but others they pass by. No, the plants they leave in the ground are not by any means poor specimens; they are young guayules, as yet under 18 inches high, which are being left to grow and furnish another profitable crop.

Presently we espy quite a number of donkeys coming leisurely along towards us over the plain. They have been down to a packing-shed close by with a load of guayule, and are now returning for another load. When they reach the harvest-field, great bundles of the shrub are piled up on their backs, until we can hardly see anything of the useful little beasts but a row of heads and an array of paws. However, their burden is not so heavy as its bulk would have us imagine. We follow the caravan of donkeys to the packing-shed and see them unloaded. Then we watch the guayule being pitched by hand into crates and tightly jammed therein by being jumped on by the packers. When the bales are taken out of the crates they remind us of trusses of hay. The bales are weighed, stacked in carts, and taken to the factory.

Seated on a bale in one of these carts, we, too, go to the factory. Here we see the crop of guayule being crushed between rollers, and for the moment we are reminded of a sugar-mill. The crushed plant, a mixture of bits of wood and atoms of rubber, is conducted to a pebble-mill, which is a drum half filled with stones and water. The mill is rotated, and the rubbing action which is thus set up rolls the rubber into larger pieces and grinds the wood to pulp.

The mixture is now pumped into large tanks. The rubber, being lighter than water, floats; the wood, being heavier, sinks. The rubber is skimmed off and purified, after which it is washed and put into bags ready to go to market.

Guayule rubber is of sufficiently good quality to be used for all but the highest class rubber goods, such as surgical appliances.

CHAPTER IX

DIFFERENT KINDS OF WILD RUBBER—*continued*

THE chief wild-rubber producing countries in the Old World are Africa, Northern India, and the East Indies.

In Africa, the rubber-giving plants are the *Funtumia elastica*, a medium-sized tree, and several varieties of vine whose family name is Landolphia. Both plants flourish in the tropical forests of West Africa, extending from Soudan to the Congo, and embracing large areas in Liberia, Gold Coast, Lagos, Southern Nigeria, and the Cameroons. Landolphias grow profusely in these same forests, and in the more northerly West African districts of Senegal, Gambia, and Sierra Leone ; they also abound in British East Africa and German East Africa.

Funtumias are tapped on the "herring-bone" system. A native climbs one of the trees, and as he ascends, he makes a wide cut vertically up the trunk with a somewhat clumsy chisel or gouge ; on his downward journey he makes numerous branch cuts, which run into the central one alternately on the right and left sides at an angle of about 45 degrees. The milk which comes out of the side cuts trickles down into the central channel, where it mixes with the milk which is oozing out therefrom. The whole supply thus finds its way down to a calabash or pot, which is placed on the ground at the terminus of the "herring-bone" or "featherstitch" system.

The more destructive method of felling the trees is also adopted by the collectors of Funtumia milk.

The rubber is prepared from the milk in several

ways. The most common methods are the addition of the juice of another plant, and the burying of the milk in holes scooped out of the ground. In the latter case, an oblong hole, 2 to 3 feet deep, is made, and the inside of it is coated with clay. When the clay is dry, the milk is poured into the hole, over which is placed a lid of leaves or boughs. Under this treatment, about six weeks have to elapse before the change called "coagulation" is brought about, and then the results are far from satisfactory. When, at last, the hole is uncovered, there is a lump of rubber in place of the milk, but it usually contains a great deal of uncoagulated and partially coagulated latex. The lumps are put in the sun to dry, after which they are taken home to a forest hut. Here they are stored until such time as some of the natives set forth for the nearest centre of civilization, to dispose of a stock of rubber to the merchants. The lumps are carried to town in native-made baskets, which in shape are rather like the baskets commonly used by us for soiled linen.

The product prepared from Funtumia milk is generally known as "Lagos silk rubber."

Landolphias are large vines, which often creep up to the tops of the highest trees in the forest. They have stout stems which twist and turn, interlace and knot themselves together into a tangled mass. They are among the most picturesque of forest plants, for not only have they the habit of climbing up the trees and intermingling with the branches in a very decorative manner, but many of them bear beautiful flowers and brightly coloured fruit.

To tap Landolphias, the natives make cuts in the stems. The milk is collected and coagulated in

numerous ways. Sometimes it is allowed to flow to the ground, sometimes it is caught in pots or calabashes, which are hung by a handle on to the stem of the vine, at the spots where the cuts are made. It may be left to coagulate by itself, or the change may be brought about by the assistance of heat, or of some plant-juice, which is known to produce the desired effect. Sometimes a native smears the milk over his body, and peels off the skin of rubber into which it is changed by his own warmth.

Some of the Landolphias have underground stems, or "rhizomes," which, when pounded, yield "root rubber."

Landolphia rubber is sent to market in many forms, of various shapes and sizes. Balls, lumps, biscuits, morsels called "thimbles," strips, and twists are some of the commonest forms in which it is exported.

Africa is a very important centre of rubber production from the point of view of the quantity of the material it exports. But the quality of African rubber as a whole is much inferior to that of Para, the rubber that sets the standard by which all other varieties must expect to be judged. The inferiority of African rubber is to some extent due to the milk from which it is made, but is largely the result of the way in which the milk is collected and coagulated. The work is all done by natives, men and women, whose one idea is to get as much rubber as possible in the easiest way. They are not at all careful to keep the milk free from dirt and impurities, and there is no science in their methods of coagulating it. However, England, France, Germany and Belgium, who between them own the rubber-producing colonies of Africa, are now taking

active steps to improve the quality of African rubber. You will understand why they are so anxious to bring about changes for the better in this respect when I tell you more about the growing popularity of plantation rubber, the rival of all wild rubber.

There is one kind of rubber plant which all of you must have seen. It is grown here in pots, and is much used for indoor decoration. Its botanical name is *Ficus elastica*.

When you see *Ficus elastica* in its native element, you can hardly believe that it is exactly the same species of vegetation as the small "rubber plants" whose acquaintance you have made in many a hall and drawing-room. At home, on the lower slopes of the mountains of Northern India—in Darjeeling, Sikkim, Bhotan, Assam, and Burma—and in Java and Sumatra, it is a big tree, which has very peculiar habits. In the early years of its life the tree has a single trunk, with numerous branches. The branches soon begin to let down bush-ropes, which in growing reach to the ground. Here they enter the soil and take root, and as these new roots spread, the bush ropes develop into big trunks. A well-established Ficus is a most curious sight. It has claimed for its own an extensive ground space, the whole surface of which is occupied by exposed roots. Rising from their midst is a crowd of large trunks; and high and low among the branches are the aerial roots, from which all but one of the crowd came into existence as bush-ropes.

To get at the Ficus milk, the natives hack great pieces out of the trunks of the trees. Like the Africans, they sacrifice quality to quantity in their general methods of collecting and preparing their rubber.

(1)



(2)



(1) CEARA RUBBER TREE IN CEYLON. *Page* 64

(2) PARA RUBBER TREES, 27 MONTHS OLD, CEYLON. *Page* 65

From photographs in the Ceylon Section of the Imperial Institute, by permission

The material made from Ficus milk is commonly known as Assam rubber.

Rubber of various qualities is now made from the latex of the Jelutong tree. This tree, which is a giant among forest giants, flourishes in the jungles of Sarawak, Borneo, Sumatra, and Malaya. The tapping of Jelutong is roughly done by natives, and the milk is coagulated by the help of petroleum.

CHAPTER X

KINDRED PRODUCTS TO RUBBER

DISTINCT from rubber, but closely akin to it, are the two materials known as "gutta-percha" and "balata."

The gutta-percha tree has its home in the Far East, in Malay, the East Indies, and the South Sea Islands. The trees are sometimes tapped as they stand, by a similar method of V-shaped cuts as is practised by the Nicaraguans in tapping Castilloas. Sometimes they are felled, trunk and branches being then ringed with cuts.

Gutta milk, like rubber milk, is white. Sometimes it flows freely, in which case it is collected in cups or calabashes. It always coagulates very quickly, sometimes so rapidly that none runs out of the cuts; these get filled up with solid strips, which can be pulled off. Frequently it runs so gently that it can be collected on a bit of coagulated gutta. When a small pellet of solidified gutta is rolled along a cut, the fresh milk sticks to it, and quickly hardens. In some districts the free-flowing gutta milk is coagulated by boiling.

In others it is left to itself to turn into a thick cream, and is then coated over a piece of completely coagulated gutta.

Most of the gutta-gathering is done by natives, who deal very roughly with the trees, and are not at all particular about the quality of the material they prepare. But Britain, England, Holland, and Germany, who all own territory in those parts of the world where the gutta-percha tree grows, are anxious to improve the conditions under which the raw gutta industry is carried on. Already some desirable changes have been brought about, and efforts are being made to introduce other reforms in connection with working methods and general organization. Under European supervision, gutta-percha is now extracted from the leaves of the tree. And there is an estate, belonging to the Netherland Indian Government, where the best varieties of gutta-trees are being cultivated, to make up for the scarcity of them that has been brought about by the destructive methods of the native workers in the forests.

Gutta-percha lacks some of the valuable qualities of rubber: it is not elastic, in ordinary temperatures it is quite hard, and when it gets very dry it is brittle. For manufacturing purposes it has to be heated, when it can be moulded into the desired form; but as it cools, it hardens again. It is used chiefly for insulating submarine cables.

Balata is the product of a tree which flourishes in the forests of British Guiana, a little-known but magnificent country in the north-eastern corner of South America. The forests of British Guiana are a continuation of the forests of the Amazon, which they



M. S. Nakajima, Kuala Lumpur

CLEARING THE JUNGLE IN MALAYA. *Page* 72



M. S. Nakajima, Kuala Lumpur

A CLEARING IN THE MALAY JUNGLE: READY FOR PLANTING HEVEA RUBBER *Page* 72

closely resemble. At present, they are only known to a few explorers, the balata-bleeders, a few seekers after gold and diamonds, and odd travellers who like to get away from the beaten tracks. In all my wanderings East and West, I have had few such delightful experiences, none more interesting and novel, than my trip to these forests. Yet, although they occupy by far the greater part of a British Colony, which is about equal in size to England, not one Briton in a thousand knows anything about them. Indeed, so little does the Mother Country appreciate the importance of owning a part, although only a comparatively small part, of the rapidly developing Continent of South America, that very few Britons know British Guiana by name even, and the majority of these imagine it is the same country as British New Guinea.

Most of the balata-bleeders are niggers, the present-day natives of the Colony. The life they lead is rough and solitary, very much like that of a seringueiro.

The balata-gathering season begins in the latter part of May, but weeks before this many of the labourers have to set out on the long journey to the particular part of the forest where their work lies. They are employed, under contract, by companies who hold licences to collect balata from such or such tracts of the forest, called "grants." All employees are paid according to the results they can show in solid balata, so much for every pound of the material; but they must go where they are sent to find it, and getting there is such a difficult and trying business that work may well be considered to begin with the journey to the grants.

Balata trees grow wild throughout the Colony.

Sometimes they are found in groups, sometimes scattered about amidst the many other varieties of trees which crowd the forest. Some of the grants that are being worked are in the lower valleys of the rivers. But in a country where "inland" is a dense barrier of virgin bush, with its face quite close to the coast, it is a long journey even to districts which are said to be "most accessible," because they happen to be nearer than others to some place where there is a town or village. Many of the most accessible balata-grants are a two or three weeks' journey away from the nearest centre of civilization. And it takes from four to six weeks to reach some of the remote ones in the far interior.

The rivers, with their tributaries and creeks, are the only means of communication with the grants. Owing to the enterprise of a local firm, there are steamer and launch facilities on nearly all the main rivers, but although the vessels can perform marvellous feats in the way of shooting rapids and manipulating falls, sooner or later the terminus of each civilized, up-country service is fixed by long stretches of disturbed waters, which cannot possibly be navigated by big craft.

To the majority of the balata-bleeders, Sprostons' steamers are a great boon. But even when these men are going to one of the grants on the near side of a steamer terminus, they are pretty sure to have to rough it on the last part of their journey, for nearly all the grants are situated on the banks of a tributary or creek.

Here is a rough sketch of one journey in which use can be made of the civilized travelling facilities. The balata-bleeders leave Georgetown, the capital of British

Guiana, in the early morning, and go by steamer up the Demerara River. By midday they have passed the bounds of cultivated country; the Demerara sugar-cane lands have given place to virgin forest. By about five in the afternoon they reach Wismar, where they leave the steamer. Here, thanks again to Sprostons' determined efforts to open up the Colony, there is a train awaiting them. Right through the heart of the forest runs the only bit of railway-line in the whole interior of British Guiana, connecting Wismar on the Demerara River, with Rockstone on the Essequibo.

Why, as they want to get on the Essequibo, do they not go by boat direct through its mouth, and upstream to Rockstone by its course?

Time was when the balata-bleeders bound for Essequibo grants were obliged to follow this route; but many were the lives that were lost in the dangerous falls that block the lower part of the river. The railway was built to complete a safe passage round to Rockstone, above these falls, via the Demerara River and a cross-country cut.

The run from Wismar to Rockstone, which takes about a couple of hours, completes the first day's stage of the journey. After a night's rest in a wooden shanty, the travellers must follow one of two methods for proceeding on their way. They can at once take to small boats, or they can go on by launch for a couple of days before being actually compelled to adopt the slowest and most laborious means of river-transit.

The visitor to Rockstone is sure to see some open boats tied up to the landing-stage. On first making the acquaintance of these rough-looking little craft, he

imagines they are merely for the use of men who want to go a-fishing for a few hours, or for anyone who has to make short river-trips. On going down to the landing-stage a few hours later—if he is in this part of the world during the early months of the year—he is surprised to find that some of those old tubs have been transformed into tent-boats, that the space beneath each awning is crowded with stacks of small cargo, such as packing-cases, hammocks, pots and pans, and that round and above the piled-up goods and chattels stretch long lengths of string laden with calabashes. He is still more surprised when he learns that a large party of balata-bleeders is about to set forth in these boats on a two, three, or four weeks' journey. Not an inch of accommodation does there seem to be left for passengers ; yet several men manage to squeeze into each boat. They pass long day after long day in their cramped quarters, smoking, gossiping, dozing, and taking their turn at the paddles. At night they go ashore, and camp in the forest ; they light a fire, have a picnic, sling their hammocks, and turn in to sleep until daylight makes it possible for them to get a little farther on their way to work. On days when they have to navigate one set of rapids after another, and drag the boat overland past fall after fall, it is but a very little farther they are able to push forward.

The labourers who leave Rockstone by launch find little boats waiting for them when they reach the camp that is situated at the terminus of civilized travelling facilities in the wilds. They then have to rough it for the rest of their journey.

On one of the riverways which leads to many grants, there is no steamer or launch to help the labourers on



WEEDING YOUNG RUBBER IN MALAYA. *Page* 76



LOADING RUBBER IN MALAYA. *Page* 86

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their way. The work of paddling the boats along this route is made specially hard by masses of grass, which drift down from the Savannahs. A way has to be hacked through the floating barriers with cutlasses. You can imagine what a difficult task this is when I tell you that the grass on the water is sometimes so firm that people can walk on it.

When a balata-bleeder reaches his destination he builds himself a hut—a wooden framework, thatched with leaves. Then he makes a dabree, a large tray about half a foot deep, in which balata latex is coagulated. The dabree is composed of closely-fitted strips of palm, the crevices between which are filled with damp clay or earth. The joins are dried in the sun, after which the tray is made water-tight with a lining of balata. When the dabree has been fitted to a frame, and a screen of palm-leaves has been put up on the windward side to keep off the rain, the whole construction looks very much like a bedstead.

Next comes the work of locating balata-trees within the appointed tract. This is a serious version of the game of hide-and-seek. The trees are concealed somewhere—anywhere among other trees and a tangle of undergrowth and overgrowth ; the nigger-man who has come to find them has to clear the way for every step he takes in looking for them. After he has discovered a number of them, he makes his plans for going the round of these to collect a supply of latex.

Each tree is tapped by means of a cutlass, an implement which the British Guiana nigger uses for cutting anything from a loaf of bread to a path through the bush. The cuts are made in featherstitch pattern, running from the base of the trunk to a great height

thereon. The operator stands on the ground to make the lower ones ; when he has reached as far up as he can in this way, he climbs the tree by means of a bush-rope ladder, or hauls himself up in a rope cradle, or on stirrups made by twisting a rope spirally round the trunk. At the base of the trunk a calabash is put, and the latex trickles down into this by way of the zigzag cuts.

The latex is poured into the dabree, where it naturally coagulates into sheets. These sheets are hung up first on the framework of the dabree to drain, and then in a shed to dry ready for being sent down to town, to the owners of the grant.

Under peril of losing their licence, the owners are responsible for seeing that their labourers obey certain regulations, which have been made with a view to keeping the balata-trees in good condition. No tree may be tapped until its trunk measures 3 feet round at a distance of 4 feet from the ground. Only half the trunk surface may be bled in one season ; the cuts must not completely penetrate the bark, must not be more than $1\frac{1}{2}$ inches wide, and there must be a distance of at least 10 inches between any two of them. No part of a tree may be retapped until the old wounds have quite healed, a process which takes from four to five years.

Balata is largely used for machinery-belting. The latest statistics give the total weight of balata exported by British Guiana during the first nine months of the year 1910–1911 as over a million pounds.



PAY-DAY ON A RUBBER ESTATE, MALAYA

From a photograph by the Malay States Information Agency.

CHAPTER XI

THE STORY OF PLANTATION RUBBER

THE earliest experiment in cultivating rubber was made only as far back as the seventies of last century. And it is only within the present century that cultivated rubber, or, as it is more generally called, "plantation rubber," has become a power in the industrial world.

The hero of the romantic story of that earliest experiment is Mr. H. A. Wickham. After long and careful study of rubber-trees in the Brazilian forests, Mr. Wickham came to the conclusion that it would be possible to cultivate these valuable plants, and that the Eastern Tropics would prove particularly suitable as a home for their adoption. Experienced agriculturists and everyone connected with the rubber business looked upon these ideas as the wild dreams of a man who had more imagination than sense.

Nothing daunted, Mr. Wickham determined that at least he would put to the test his theory that rubber seeds sown by man would grow quite as well as seeds scattered by the trees themselves, provided they were reared in suitable soil and in a similar climate to that of their forest home. He began to plant seeds of the Hevea tree in Brazil, turning into a nursery for them a piece of ground near to where he was living at the time.

Little did he think then that the day was not far distant when he would be given an opportunity of putting his theory to the test on a very much bigger scale, and in the East, too.

In 1871 this energetic pioneer had published a book entitled "Rough Notes of a Journey through the Wilderness," wherein were included drawings, made by himself, of the leaf, seed-pod, and seed of the *Hevea brasiliensis*. These drawings came under the notice of Sir Joseph Hooker, who was then Director of Kew Gardens, and attracted his attention to the subject of rubber cultivation. Sir Joseph soon became keenly interested in Mr. Wickham's ideas. Not only did he favour the theory that rubber-trees could be cultivated, but he fully agreed that the Eastern Tropics would make a capital experimental nursery for them, and thought that the East ought not to neglect so promising a possibility of agricultural development. He managed to win for the cause of rubber cultivation its third supporter, Sir Clements Markham of the India Office. Sir Clements, in his turn, did his best to interest his colleagues in the proposed new branch of agriculture, with the result that in 1876 the Indian Government agreed to find the money for the introduction into India of "the tree which produced the true 'Para' rubber of commerce."

Mr. Wickham, who was still living in the up-country region of Brazil, was deputed to carry out the commission. His instructions were to obtain a large number of Hevea seeds, and get them delivered to the Indian Government. Although he was not hampered by any restrictions as to ways or means, this was a difficult enough task. The seeds would have to be collected at the particular season when they ripen; they would have to be very carefully packed for their journey so that they should not get damp, and yet should obtain enough ventilation to keep them alive;

they must not be very long out of the ground ; and, if anyhow possible, they must be got out of the country without the Government of Brazil knowing what was happening, for the authorities might say they would not allow them to be taken away.

If Brazil had known what a certain ship which left the country in the early part of 1876 was carrying, and if she had guessed what a revolution in the rubber world its cargo was destined to bring about, there is little doubt but that she would have seen to it that no Hevea seeds ever went to foreign lands.

But I am anticipating a state of affairs which is present-day history. Here, in his own words, is the romantic story of how Mr. Wickham accomplished his task.

"Whilst I was still boxing about for, or to find, some practicable way, the few European planters in that remote locality were surprised and startled by news of the arrival on the great river of a fully-equipped ocean liner. This was not a little added to on receipt of an invitation to a dinner on board the ss. *Amazonas*, Captain Murray, as the first of the new line of 'Inman Line Steamships, Liverpool to the Alto-Amazon direct.' The thing was well done. The ship's boats took us off at Santarem, and we found the ship dressed out in blue lights. We were entertained by the two gentlemen, as in charge of 'inauguration of the new line.' We had an altogether unlooked-for good evening on board, with a well-appointed supper in the saloon. The following day she went on her way for the Upper Amazon. I then thought no more about the episode in rumination on any conceivable means of effecting my purpose with regard to getting out a stock of the

Para rubber-tree ; and the more anxiously as I knew the season for the ripening of the seed on the trees in the forest to be drawing near.

"Then occurred one of those chances such as a man has to take at top-tide or lose for ever.

"The startling news came down the river that our fine ship, the *Amazonas*, had been abandoned, and left on the captain's hands, after having been stripped by the two gentlemen supercargoes (our late hospitable entertainers !), and that without so much as a stick of cargo for return voyage to Liverpool. I determined to plunge for it. It seemed to present an occasion either 'to make my spoon or to spoil the horn.' It was true I had no cash on hand out there, and to realize on an incipient plantation, in such a place and situation, was quite out of the question. The seed was even then beginning to ripen on the trees in the *Monte alto*—the high forest. I knew that Captain Murray must be in a fix, so I wrote to him, boldly chartering the ship on behalf of the Government of India ; and I appointed to meet him at the junction of the Tapajos and Amazon Rivers by a certain date.

"There was no time to lose. Hurriedly getting an Indian canoe, posting up the right coast of the Tapajos, and traversing the broad river—rather ticklish work in a small canoe at that season—I struck back from the left shore for the deep woods, the *Monte alto*, wherein I knew were to be found the big, full-grown Hevea trees. . . .

"Working with as many Tapüyo Indians as I could get together at short notice, I daily ranged the forest, and packed on our backs in Indian pannier baskets as heavy loads of seeds as we could march down under.

I was working against time. Sometimes, however, during times of rest, I would sit down and look into the leafy arches above, and as I gazed, become lost in the wonderful beauty of the upper system overhead—a world of life complete within itself. This is the abode of strange forms of life, strangely plumaged birds, and elfish little *ti-ti* monkeys, which never descend to the dark soil throughout their lives, but swing and gambol in the aërial gardens of dainty forms and sweet-smelling orchids, for every great tree supports an infinite variety of plant life. All overhead seemed the very exuberance of animal and vegetable existence, and below, its contrast—decay and darkness. Here and there a mass of orchid, carried from above by the fall of some withered branch, sickening into pallor, thrust out from the vitalizing air and life above.

"I got the Tapüyo village maids to make up open-work baskets or crates of split *Calamus* canes for receiving the seed, first, however, being careful to have them slowly but well dried on mats in the shade, before they were put away with layers of dried wild banana leaf betwixt each layer of seed, knowing how easily a seed so rich in a drying-oil becomes rancid or too dry, and so losing all power of germination. Also I had the crates slung up to the beams of the Indian lodges to insure ventilation.

"I was working against time. It was true that the seed would still continue to ripen, and to fall from the trees for another month or so, but it would be inexpedient to risk the vitality of some thousands I had succeeded in securing. The rendezvous with Captain Murray of the *Amazonas* would soon fall due at the river mouth, and if I missed that, when and how another

such opportunity ? I had got to look upon the heavy oily seeds in their dappled skins as become very precious, after having backed them down so many long days tramping across the forest plateaux, and so lost no time in getting them carefully stowed under the *tolda* of the canoe, and starting away downstream, duly meeting the steamer, as appointed, at the mouth of the Tapajos.

"I found Murray crabbed and sore from the experiences with his two rascally supercargoes. It appeared they had given instructions to land the whole of the trade-goods with which his ship had been freighted ostensibly for purchase of incoming rubber-season crop at the town of Manaos. He was then to anchor his ship at the *boca* of the Rio Negro and 'await orders,' they meanwhile to dispose of the goods, and to advise when they had got together sufficient rubber in order to load ship for the return trip. The time becoming unaccountably long, he landed, and on making inquiry he could only learn that the goods had indeed been disposed of, but no one could give any information as to his two supercargoes, and so found himself left with an empty ship on his hands.

"For my part, as the fine ship sped on her way with my prospective Hevea so far safe aboard, slung up fore and aft in their crates in the roomy, empty forehold, I became more and more exercised and concerned with a new anxiety, so as not much to heed Murray's grumpiness. We were bound to call in at the city of Para, as the port of entry, in order to obtain clearance for the ship before we could go to sea. I was perfectly certain in my mind that if the authorities guessed the purpose of what I had on board, we should

be detained under plea for instruction from the Central Government at Rio, if not interdicted altogether. I had heard of the difficulties encountered in the Clements Markham introduction of the *Chinchonas* in getting them out from the Montaña of Peru. Any such delay would have rendered my precious freight quite valueless and useless. But again fortune favoured. I had 'a friend at court' in the person of Consul Green. He, quite entering into the spirit of the thing, went himself with me on a special call on the Barão do S——, 'chief of the Alfandiga,' and backed me up as I represented 'to his Excellency my difficulty and anxiety, being in charge of, and having on board a ship anchored out in the stream, exceedingly delicate botanical specimens specially designated for delivery to Her Britannic Majesty's own Royal Gardens of Kew. Even while doing myself the honour of thus calling on his Excellency, I had given orders to the captain of the ship to keep up steam, having ventured to trust that his Excellency would see his way to furnish me with immediate dispatch.' An interview most polite, full of mutual compliments in best Portuguese manner, enabled us to get under way as soon as Murray had got the dingey hauled aboard.

"Now fairly away, I could breathe freely, and soon had the hatches off with the open-work crates slung up on lines fore and aft in the air, and free of danger from ship's rats. Again blessed with fine weather, I was able to keep the hatches off all the way over.

"I got Murray to put me ashore at Havre, and there posted over to Kew, saw Sir Joseph Hooker, so as to enable him to dispatch a night goods-train to meet the ship *Amazonas* on arrival at the Liverpool docks.

"June, 1876, was a time of commotion at Kew, as they were compelled to turn out orchid and propagating houses for service, and to make room for the sudden and all-unexpected inroad of the Hevea; but Sir Joseph was not a little pleased. The Hevea did not fail to respond to the care I had bestowed on them. A fortnight afterwards the glass-houses at Kew afforded (to me) a pretty sight—tier upon tier—rows of young Hevea plants, 7,000 and odd of them."*

CHAPTER XII

HISTORIC DEVELOPMENTS

WHEN the Para seedlings were ready to be transplanted into the open, India could not afford to adopt them. So the majority of them were sent to Ceylon, and small batches to Burma, Java, and Singapore. The West Indies, too, were given a few to experiment with, but the seeds had been obtained specially for the purpose of introducing Para rubber into the East, so naturally the seedlings were nearly all distributed throughout the Eastern Tropics.

Most of the seedlings that went to Ceylon were planted in the Botanic Gardens at Heneratgoda, near Colombo, which were specially opened in the low-country region as an experimental centre of rubber cultivation. A few of them, however, were given a home in the island's world-famous Gardens at Peradeniya, in the up-country neighbourhood of Kandy. The plants at Heneratgoda flowered for the first time

* "On the Plantation, Cultivation, and Curing of Para Indian Rubber," by H. A. Wickham (Kegan Paul, Trench, Trübner and Co.).



C. H. Kerr & Co., Kandy, Ceylon

A GENERAL VIEW OF TAPPERS AT WORK ON A CEYLON RUBBER ESTATE. *Page 78*

in 1881, at the age of five ; those at Peradeniya did not flower until 1884.

There are differences of opinion as to the career of the seedlings which went to Singapore. It is known that as early as 1880, some Hevea trees were in flower at Perak, a mid-region of the Malay Peninsula, and that in 1881 some of those in the Botanic Gardens at Singapore, in the south of the Peninsula, bore fruit. These trees may have been reared from Kew seedlings ; or they may have been grown from cuttings of the young trees at Peradeniya, sent over to Singapore in 1877 ; or, again, they may have been transplanted one-year-olds from Ceylon. In any case, Heveas in the Malay Peninsula were yielding seed as early as their near relatives in Ceylon. And it is the seed supply of these two countries that has brought into existence the numerous and vast rubber plantations that now occupy a very large area of the Eastern Tropics.

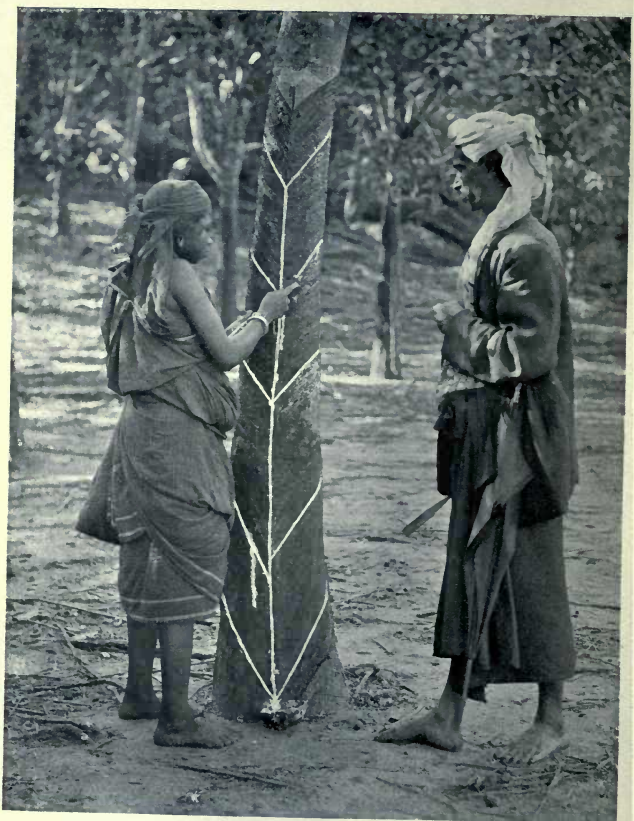
For quite a long time rubber-growing was generally looked upon as a new hobby for botanists, and anyone who prophesied a commercial future for plantation rubber was dubbed a crank. Meanwhile, enthusiasts on the staff of the Botanic Gardens in Ceylon and Malaya continued to ride their hobby-horse, in that they devoted earnest attention to the new specimens that had been placed under their care. As soon as possible they began to take cuttings from the Hevea trees, and in 1878 no less than five hundred rooted plants were sent from Ceylon to British Burma and Madras. Then came the time when the trees began to furnish a good supply of seeds. By 1886, both Ceylon and Malay were in a position to begin distributing seeds among other countries that wanted to

experiment in rubber cultivation, and in the course of the next few years supplies were sent to Queensland, Java, Fiji, Borneo, German East Africa, and Jamaica. But in most cases the packages went to botanists—with an odd exception or two, planters and business men in general would have nothing to do with rubber cultivation.

Presently, the planters in the Malay Peninsula found themselves in a very desperate position. They had been growing coffee, and doing splendidly with the crop, but conditions now conspired to cut down their profits to such an extent that their only chance of not being utterly ruined was to give up competing in the coffee market. In despair they began to plant Hevea. This change only took place as recently as 1895. And still the planters of Ceylon could afford to laugh at the idea of anyone trying to make money out of rubber-growing—they were doing well with their tea.

The pioneers in Malay had a very hard struggle to keep their heads above water whilst their rubber-trees were growing. They had to wait five years before they could begin tapping, and few indeed were the people with sufficient faith in what the harvest would be to advance them any money for working expenses.

Came the day when motor-cars got so far beyond being a fashionable craze that people began to realize they would soon be a necessary means of locomotion in this age when everyone is in such a hurry. Rubber tyres were going to be so much used in the near future, said someone to somebody else, that it looked as if we should want more rubber than was being supplied from the forests. The idea spread, and by 1898 a few more people had become enthusiastic about rubber



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TAMIL WOMAN TAPPING RUBBER-TREE UNDER SUPERVISION OF A KANGANY, ON A CEYLON ESTATE. *Page* 80

cultivation — larger areas were put under Hevea in Malay, and rubber planting was begun in Ceylon, even though tea-growing was paying so well. By 1899 it had been proved that Hevea trees would yield marketable rubber ; in this year the first cultivated Para rubber, prepared from the trees planted in Perak, was sold in the London market at 3s. 10d. per pound.

But it was not until about 1905 that money was at all freely forthcoming for rubber cultivation. Hitherto the planter who had wanted to turn his estate into a company, because he lacked means for its upkeep and development, could only hope for support from private friends. Now that there was an actual output of plantation rubber from the East, the great financiers who had looked upon any prophecy of such a supply as a fairy tale began to think that it was worth while to risk money in an enterprise which gave such sound promise of yielding extraordinarily large profits. The amount of money that was now available for rubber-growing gave scope for a considerable development of the industry. The acreage under Hevea was increased on the existing estates in Malay, and jungle was cleared for the opening up of new estates ; in Ceylon, Hevea was planted on a large scale among the flourishing tea-bushes, and rubber-planting was seriously undertaken in the commercial spirit in other parts of the Eastern Tropics, also in tropical lands of the West.

As yet, however, the public had not awakened to the money-making possibilities of rubber cultivation. At last, in the spring of 1910, they suddenly " discovered " plantation rubber. Some of the companies owning Eastern estates which had been planted up with Hevea in 1905, or earlier, had paid to their share-

holders in 1909 interest amounting to 80, 165, even 300 per cent., and tongues will very quickly wag into fame an industry that yields such enormous profits. Also, the price of rubber was going up, and people began to talk about the large number of new uses to which the material was being put. It was now widely believed that there would be such a shortage of rubber in the near future that the supply would fetch famine prices, and consequently the value of rubber shares would rise by leaps and bounds. The fact that some people thought they stood to make money by a judicious purchase of shares in certain estates, about the working of which they had some knowledge, was now quite sufficient to persuade people who had never given a moment's serious attention either to the industry in particular or to speculation in general that they could quickly make a fortune by investing in any so-called Rubber Company. Whilst these ideas were spreading like wildfire, the price of rubber was going up and up, until at last, in the spring of 1910, the moment came when a feverishly excited public made that historic run on rubber shares which is known as the "Rubber Boom."

CHAPTER XIII

THE RUBBER BOOM

THE boom was a very big gamble, in which men and women of all classes and nationalities took part. The great game was to buy shares, which is to say, partnerships, in companies that went in for rubber-growing, and to sell them within a few hours, or days, at a

profit. The game was played with great success by many people for several weeks. Two or three examples will show you in plain figures how fortune-making was possible.

At the beginning of the boom, the value of shares in a certain rubber company was 19s. each ; during the boom the great demand for these shares forced their exchange price up to 70s. each. Suppose, therefore, someone had bought 4,000 of them at the 19s. price ; if he was lucky enough, or smart enough, to sell them when they were fetching 70s. each, he would clear, roughly, about £10,000, after paying commission to a member of the Stock Exchange whom he had to employ to carry out the deal for him. Again, on a certain night shares in another company were selling at 27s. each. The next morning some favourable remarks about this company's rubber plantations appeared in the newspapers, and so anxious were people to get shares in the concern that they at once offered 35s. apiece for them. Therefore, people who had bought these shares during the previous afternoon had the chance of selling them at a profit of 8s. apiece within a few hours.

Under ordinary conditions, people buy shares with a view to holding them, and receiving a proportion of the profits made by the enterprise in which they have taken a partnership. During the Rubber Boom, no one bought shares with this idea. The game, as I have told you, was to buy at to-day's price, utterly regardless of whether it was a fancy figure, and trust to luck that very soon there would be some other people so anxious to get the shares that they would be willing to give a much bigger price for them.

The Boom provided a fine opportunity for cheating, of which some people took advantage. The public were invited to buy so-called rubber plantations, that were mere tracts of jungle. And genuine plantations were offered to them for a sum much above their value. No one made any inquiries as to what he was buying—all that anyone wanted at the moment was a piece of paper which set forth that he was the owner of some rubber shares, so that he could sell his rights to someone else at a profit. But on the whole, seeing how big was the chance for cheating, the public were not made victims by many unscrupulous folk. They were their own worst enemies during the boom, for by their mad eagerness to gamble in rubber shares, they forced up the price of shares in the many thoroughly genuine plantations to a value that was out of proportion to the profits which could be made on the rubber produced—at any rate, for some time to come.

Of course, the day came at last when the public began to feel they were playing a reckless game. Newspapers were warning them of the risks they were running; rumours were abroad that certain shares were not worth a penny, since they represented partnership rights in land which had not been cleared of jungle, let alone planted up with a single rubber-tree; hints were going round that the rubber-trees on some of the genuine plantations were being overtapped in order that for the moment big profits should be made at any cost, to compare well with the present high price of shares. People saw themselves losing heavily, sooner or later, if their shares were left on their hands. Now everyone was feverishly anxious to sell, and hardly anyone wanted to buy. Prices which had risen

(1)



(2)



(1) PARA RUBBER SEEDS AND PODS

(2) TAMIL COOLIE PLANTING RUBBER. *Page 72*

From photographs in the Ceylon Section of the Imperial Institute, by permission

so rapidly went down with a slump even more rapidly. More fortunes were lost in that Slump than were made during the Boom, and some of the folk who were most badly hit in the end were people who had won large sums at the beginning of the game, and had thus been tempted to go on playing more and more recklessly.

Among the few who profited in the long-run were men who had pinned their faith to plantation rubber long before the Boom. Some of them had brought the rubber plantations into existence, had worked hard at clearing jungle and planting rubber-trees, had struggled to pay their way the while they brought up those trees to producing stage, in the days when the public would not have risked a penny on any such hazardous venture as rubber-growing, even if they had been wide awake enough to know that a few enthusiasts and a few hard-up planters were trying to establish this new branch of agriculture. When these men had been obliged to get a few friends to help them turn their property into a partnership concern, because they wanted ready money to go on with, they had taken some of the purchase price of their property in the form of shares, so that they themselves could be partners. Fortunes were also cleared by outsiders who had had enough faith in plantation rubber to buy shares when the earliest planted estates were turned into companies, for all the people who had taken over or bought shares for a small sum were able to sell their partnership rights at a big profit in the early days of Boom. Many of them bought back shares when prices fell, and bargain after bargain was picked up during the Slump by people who knew which companies possessed the best plantations.

You must not imagine that the crash put an end to rubber-growing. True, the faith of the public in this industry had been roughly shaken at the critical time when that faith was just beginning to bud ; but the industry was sufficiently well-established to withstand this check, and go on fighting to attain its main object —to become more popular than Wild Rubber with the manufacturer.

CHAPTER XIV

WILD RUBBER *v.* PLANTATION RUBBER

THE Eastern Tropics are the chief seat of rubber-growing, and the countries in which the principal plantations are situated are Ceylon, Malaya (Federated Malay States and Straits Settlements), Java, Sumatra, and Borneo. But the new industry is also receiving considerable attention in the West, where much planting has already been done by Brazil, Central America, Mexico, the West Indies, and British Guiana.

The bulk of the cultivated trees are of the *Hevea brasiliensis* variety. But many other kinds of rubber are grown, chiefly in the districts where the *Hevea brasiliensis* will not flourish ; for instance, Central America is devoting much attention to *Manihot Glaziovii*, a native of Brazil, as this tree will do well on rocky and stony soil. Manihots are grown in many other parts of the world, and the rubber they yield, called " Ceara " rubber, is of good quality. Several countries are cultivating their native varieties of rubber-trees. Thus Brazil is beginning to grow *Hevea brasiliensis*, Mexico has Castilloa plantations, British

Guiana is experimenting with its Sapiums, and Africa has planted Funtumia.

But at present the only plantation rubber which wild rubber has to fear is the Para that is exported from the Eastern plantations. You remember how recently the first rubber plantations were established in the East ? Now, here are a few facts which will give you a rough idea of the enormous developments that have been brought about in a very few years.

In the Malay Peninsula, 400,000 acres of land are already planted up with Hevea ; about 180,000 natives are employed on the estates ; over £23,000,000 of money has been invested in rubber-growing. This country exports the largest amount of cultivated rubber ; its output has increased from 130 tons in 1905 to 6,504 tons in 1910. The total value of all the rubber exported by Malaya from 1905 to 1910 was £10,225,000.

In Ceylon, the rubber plantations occupy about 200,000 acres of land. Nearly all the trees have been planted since 1904. In 1910, the exports amounted to 1,601 tons ; it is estimated that the amount of rubber produced in 1911 will be nearly 4,000 tons. So popular has rubber-growing become in this part of the world that the flourishing tea-bush has had to give place to Heveas on hundreds of acres in the lowlands. And rubber-trees are now competing with tea-bushes for many a highland acre. They have shown that they can live and do well on heights up to about 2,000 feet, so more and more of them are being planted on the hills among the little tea-bushes, and the old crop that has made so much money for Ceylon is dying off for want of light and air, as the promising new crop

grows bigger and taller, until the trees completely overshadow the dwarf bushes.

In Java, about 160,000 acres are under rubber. *Hevea brasiliensis* has sole possession of about 92,000 acres, the remainder of the rubber lands being planted up with Ficus, Castilloa, Ceara, and Manihots, with some Hevea in their company. The rubber in this country has not been planted long enough for the production to be very large, but it is estimated that after the year 1916 at least 20,000 tons of Para and 1,500 tons of other sorts will be exported yearly.

Throughout the East there are thousands of acres of rubber-trees that have not yet reached the producing stage. It is estimated that when all the trees now planted are yielding, the output of plantation rubber from the East alone will probably be three times as large as the Amazon crop of to-day.

Can the world make use of all the rubber that will be available in the near future? If not, the manufacturer will be in a position to say whether he will buy more wild than cultivated rubber, or more of the cultivated than of the wild. Which will he favour? These are the great questions that are occupying the minds of everyone who is interested in rubber production.

It is sheer folly for anyone to attempt to prophesy what is going to happen in the Rubber World; there are far too many possibilities to be taken into consideration. For instance, the world may find that it wants all the increasingly large amount of rubber that is produced. There are already many known ways in which the material could be used with advantage if it could be bought at a cheaper rate; for instance, our



M. S. Nakajima, Kuala Lumpur

CARRYING LATEX TO FACTORY IN MALAYA *Page 81*

pavements would very likely be made of rubber under such circumstances. And who can tell what the morrow may bring forth in the way of a discovery in which rubber is called upon to play an important part ? Again, some chemical substitute may be produced so cheaply that the manufacturer gives up buying any sort of natural rubber ; many people are busy trying to invent such a substitute, but although it has been found possible to make what is known as "synthetic rubber" from chemicals, all the processes so far invented are very expensive. Then there is "reclaimed rubber" to be taken into consideration. Already there are some important factories where new rubber is made from all sorts of worn-out rubber goods. And this "reclaimed" or "reformed" material is becoming very popular with manufacturers of rubber goods.

But although the future is so very uncertain, there are things actually happening at the moment which tempt many people to prophesy now this, now that. In glancing at the activities which are making present-day history in the Rubber World, and trying to influence its future history, let us first see what plantation rubber is doing to win favour with the manufacturer.

The great ambition of everyone concerned with the growing of rubber is to produce a material of first-class quality at a much lower cost than that at which the best quality wild rubber can be sold. The working expenses of producing a pound of the finest Brazilian rubber are about 3s. per pound inclusive of a heavy export duty ; it is maintained that in course of time all the plantations will be able to turn out an equally good material for which the working expenses

per pound only amount to something between a shilling and eighteenpence. At present, no popular way has been discovered for smoking plantation latex whilst it is being coagulated ; but great efforts are being made to find a simple and cheap method of curing plantation rubber as thoroughly as the Brazilian product is now cured. Meanwhile, plantation rubber is well smoked, after the milk has been coagulated, in special sheds for the purpose. Excellent material has already been produced at a total cost per pound of varying amounts under two shillings. Some of the cultivated rubber has already fetched a higher price than the best wild grade.

The price of rubber varies considerably. For instance, during the Boom the best wild grade, Fine Hard Para, was selling at 12s. 6½d. per pound, and the best cultivated Para at 12s. 8½d. In November, 1911, similar rubbers were fetching only 4s. 5½d. and 4s. 8½d. respectively. You will see from this how difficult it is to estimate the profits that a company stands to make out of a year's rubber production. During the Boom, the public believed that they could reckon on rubber fetching even more than 12s. or 13s. per pound ; before the end of 1910 it was already down to 5s. 5½d. per pound.

We must now see what people who are interested in wild rubber are doing to enable this product to hold the manufacturers' favour in competition with cultivated rubber, which is trying to oust it. I have already told you that efforts are being made with a view to getting the wild supplies collected in a more economical manner, to see that the trees are not damaged by careless tapping, and to prevent the quality of the

supplies being brought down by dirt. Brazil is also developing her railway system, opening up the far interior of the country in order to make transport quicker and cheaper, and prevent some of her most valuable rubber getting lost through boats being wrecked in the rapids.

CHAPTER XV

MAKING A RUBBER PLANTATION

We have come out to the East, to see for ourselves how rubber is cultivated. And we have chosen to spend most of our little remaining time together in the Malay Peninsula, since this is the country where the largest area of land has been given over to rubber-trees, where many of the finest plantations are situated, and where advanced methods of cultivation and manufacture are most generally practised.

Our surroundings are very Oriental, yet there are many signs that Western civilization is playing an important part in the life of this country. When our ship dropped anchor in the harbour at Singapore, we imagined that by some mistake we had been brought to a Chinese port, instead of to our proper destination in the British Straits Settlements. The quay was packed with Chinamen, or "boys," as they are all called when they belong to the working class, no matter whether their age is six or sixty. When our luggage had been seized by as many of the pig-tailed brigade as could manage to secure any one of our belongings, when we and our traps had been taken possession of by Chinese rickshaw coolies, and at last we were on the

move again, each of us being jog-trotted along in a sort of invalid chair with a picturesque, yellow-skinned ragamuffin in the shafts, we were even more sure that we were in China, and the impression became stronger still as we passed through street after street thronged with Chinese men, women, and children, and lined with shops displaying Chinese wares, Chinese signs over and around the doors, and Chinese lanterns for every-night illuminations. Presently, as we emerged into a broad thoroughfare, we found ourselves in totally different surroundings. The fine public buildings, houses, shops, and hotels looked distinctly Western; several times a minute trams and motors threatened to run down our rickshaws; we saw many English faces, heard English being spoken freely, and noticed that shops and hoardings gave us a great deal of information in the English language. But now we were thoroughly puzzled as to the nationality of Singapore. The crowd in the streets was cosmopolitan, Western and Eastern in about equal proportions, but whilst undoubtedly the West was represented mostly by English people, it was difficult to make up our minds whether there were more Malays or Chinese among the Eastern population.

Now that we have come up-country in the Malay Peninsula, it is more difficult than ever to tell from our surroundings who is the ruling power in the land. We see a few Europeans among a host of Orientals, all of whom are called "natives," although they represent many races. We are in the midst of a highly cultivated district, which is entirely devoted to rubber-growing; through its midst runs a railway, and the interior is served by excellent roads. Yet everywhere in the back-



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ground rises a wall of jungle. We are right when we jump to the conclusion that the rubber lands were once jungle too, and when we tell ourselves that, in spite of the fact that the bulk of the population of this Peninsula is Oriental, the plantations, roads, and railways owe their origin to Western enterprise and a Western scheme of development.

The Malay Peninsula consists of the Straits Settlements—Singapore, Malacca, Province Wellesley, the Dindings, and Penang, which are British, and of a number of Native States. But British influence is quickly becoming as active in the Native States as in those parts of the country which are British possessions. Indeed, four of the native divisions—Negri Sembilan, Selangor, Perak, and Pahang—are united as the Federated Malay States, and administered on up-to-date progressive British lines by a Federal Council. The Governor of the Straits Settlements, who is High Commissioner of the Federated Malay States, presides over the Council, and its membership consists further of the Sultans of the four States in question, the British Resident of each, and four unofficial members, three of whom are British and one Chinese. Three other States have a British adviser, and the Sultan of Johore has quite recently sought the aid of a similar official to help him develop his territory, particularly with a view to furthering the interests of rubber-growing.

The principal rubber lands in Malay are situated in the Straits Settlements, the Federated Malay States, and Johore. We have come to a rubber estate in the heart of the Federated Malay States, where the plantation area is about to be enlarged. Another tract of jungle is to be cleared and planted with Hevea.

For days we watch the clearing being made. First the undergrowth is cut, then the trees are felled. When these preparations are complete, a light is put to the great mass of unwanted vegetation. A big bonfire is soon raging, and when this has burnt itself out, the jungle tract has given place to a clearing that is strewn with charred stumps and a wreckage of trunks. When the clearing has had time to cool, a central road is made, and the land is divided into blocks by side-paths.

Little Heveas are now brought from an open-air nursery and planted in rows, between the stump and trunk ghosts of the dead jungle. These little Heveas have been grown from seed on a very much smaller piece of ground than that over which they are now distributed. They do not want very much room until they are about a year old, and by the method of putting treelings, instead of seeds, in a clearing, the plantation is brought to bearing-stage in about four years instead of five.

There is a great difference of opinion as to what distance apart the young plants should be put in the ground when they are transferred to their permanent home in the clearing. Some planters put in three or four hundred to the acre, and obtain quite good results ; others maintain that the trees are overcrowded, and cannot possibly grow to their full size, if more than fifty occupy one acre of land. Generally speaking, from one hundred to two hundred trees are planted per acre at the present time.

Jungle clearing is always done in the way we have seen up to the bonfire stage of the proceedings. But in some cases, further preparations are made before



SHEET RUBBER DRYING IN THE FACTORY ON PASIR OETJING ESTATE, JAVA. *Page* 66

In the foreground are trays with other sheets and some with scrap rubber

planting begins. Stumps are uprooted, and removed with all the wreckage left by the fire, so that the land to be planted is quite clean. This more thorough method is followed by growers who prefer not to run any risk of their rubber-trees becoming infected by possible disease among the trees that formerly occupied the ground ; but complete clearing is a long and costly business.

Grassland is sometimes used for rubber-growing. Paths are cleared and the rubber is planted in rows, between strips of grass ; or the whole of a given area is completely cleared before planting is begun. The most common grass, called *lalang*, is the worst pest with which many of the planters have to contend. It is difficult to uproot, and any that may be left in the ground spreads very rapidly.

In Malaya the work of clearing is nearly all done by Sakai and Malays.

The Sakai are the aborigines of the country, who live in the jungle. They are very skilful woodcutters.

The Malays, it is believed, are descended from natives of Southern India, who emigrated to Sumatra. In 1360 some of the emigrants made the short journey over to the mainland, and settled in the country which we call the Malay Peninsula. They increased and multiplied, and became more and more powerful, although first the Portuguese, and then the Dutch, tried very hard to get the upper hand of them. When the British succeeded the Dutch as the chief European power in the Peninsula, the Malays were at first left in undisputed possession of the interior of the country. But they quarrelled and fought so much amongst themselves that the interior was always in a state of

turmoil ; when they began to hamper our trade still further, by raiding our territory in the Peninsula, steps had to be taken to bring them under control. Gradually, by means of force and diplomacy, order was established, British influence was widely extended, and the Native States entered into that close political relationship with Britain which I have already summed up for you.

Generally speaking, the Malays are very different from the Sakai. The jungle-men are savages. The Malays are a civilized people ; they have a national style of dress, their conversation is witty and is frequently carried on in poetic language, they have produced some literature, and they are most artistic metal-workers.

But the Malays and the Sakai are alike in that they both want but little here below except time to loaf in the sun. Regular work they heartily dislike, and will not do. But, as a rule, they are quite pleased to make a clearing for the planter. That is a job which will come to an end some day not so very long after it is begun, and it will bring in enough money to carry them through another lengthy spell of leisure.

CHAPTER XVI

LIFE ON A RUBBER PLANTATION

DURING the time the trees are growing big enough to be tapped, the principal work on a rubber plantation consists of weeding, manuring, and pruning.

The staff consists of a manager, generally spoken of as the planter, two, three, or half a dozen assistants,

according to the size of the estate, and a number of natives, called "coolies." The planter, a white man, has his own bungalow. On the big estates such bungalows are large, well-built, convenient residences, of country-seat rank. If the planter is married, his wife probably lives with him. His business may have brought him to a lonely spot, where at present there may be only a poor sort of bungalow to serve as the manager's quarters, but his wife has chosen to rough it with him, rather than say "Good-bye." And there may be some little English girls and boys to welcome Daddy Planter when he comes in from his work of looking after many things and many people; for, as a rule, white children thrive in the tropics until they are seven or eight years old, and then, when the sad time of parting does come, they are sent "home" to England not only for the sake of their health, but in order that they may have the advantage of going to a good school. The assistants on a plantation are usually white men; in Malaya and Ceylon, almost all of them are English. They chum together in a bungalow. The labourers are coloured men, women, and children, in all shades of yellow and brown; their quarters are called "coolie lines," and are long buildings of the bungalow type, which are partitioned off into family residences.

Many of the rubber estates, especially here in Malaya, seem to be so isolated that we are tempted to compare them with a seringal in their loneliness. In reality, no plantation, even though it be in the heart of the Bush, is isolated in the strict sense of the word. Somewhere, not very far away, there is a good road leading to some centre of civilization that can be reached in a few hours, maybe an hour or two by motor. Many

of the planters keep a car, and "What's mine is yours" is the popular way of looking upon possessions. Both in Ceylon and Malaya there are many little towns scattered throughout the rubber districts, and in most of them an English Club is an important feature of the place. In both countries, too, any planter can get to a railway station without much difficulty or loss of time; and there are good day and night trains to take him to the capital, or to one of the few big towns.

With regard to the cultivation side of plantation work, the chief matter on which the planters differ is the business of weeding. Some of them are certain in their own minds that rubber-trees grow best when the ground is quite clear of weeds. Some maintain that perfectly clean weeding is a waste of time and money; they believe in having a clean circle of ground round each tree, and keeping the weeds down on the rest of the land by putting in some variety of dwarf spreading plant. Those who favour this latter plan talk of the manuring properties of such plants, and of the good they do by harbouring moisture. Planters in favour of clean weeding say such plants keep light and air from the ground, and that they are not good food for the soil. At the various Botanic Gardens, especially in Ceylon, Malaya, and Java, many scientists are devoting much time to the study of rubber cultivation and preparation, and this question as to the best method of weeding is receiving a great deal of attention.

The while we have been talking, we have been making our way to one of the oldest and finest rubber estates in the East. It is known as "Linggi Plantations"; and is situated in the Federated Malay States, in the neighbourhood of Kuala Lumpur, the chief

up-country town of Malaya, and close to Port Swettenham, the busy, up-country port which, during the last few years, has been raised by the rubber industry to a position of great importance on the Suez—Far East trading route.

"Linggi" consists of so many large plantations and up-to-date workshops that in a whole day we can only get the merest peep at the estate. We begin sight-seeing about six in the morning, just as the sun is rising, by going into one block of one plantation to see the tappers at work. We are in the midst of a carefully cultivated wood of Heveas; all around us stand a dignified army of straight, tall trunks; high overhead stretches a thick canopy of leaves. For a few moments, the landscape strikes us as being a rather sombre picture in browns and greens, and we cannot see a single human being anywhere in the scene. Presently the dawnbeams discover numerous chinks in the canopy, and come streaming through the leaves, here, there, and everywhere; the ground is bronzed, the trunks are gilded, the treetops are illuminated with quaintly shaped patches of rosy light. Then, suddenly the scene becomes a blaze of colour; strolling leisurely across the horizon come a crowd of figures, all of whom are undoubtedly wearing some bit of clothing that is bright red, green, blue, or yellow.

These people are a gang of tappers, who are going to make their daily round of certain trees from which it is their duty to collect milk. They disperse in various directions, some making straight for trees that are close by where we are standing. As we get a nearer view of the labourers, we are better able to study their picturesque attire. Some of the men are wearing

nothing but a cloth round their loins, and a handkerchief, knotted into a turban, on their heads. Many of the male folk look like women ; they have long hair, which is twisted at the neck into a " bun," and their nether garment is a piece of cotton material which is hung round the waist skirt-fashion. The women's costumes are evidently made as they dress themselves. They are clad in draperies, which hang in graceful folds. Very large earrings, nose-rings, numbers of bangles that reach half-way up the arms, and bangles round the ankles are striking features of their attire.

Most of these labourers are Tamils from India. A large proportion of the coolies employed on the rubber estates of Ceylon and Malaya consists of Tamils. In Ceylon, some of the labourers are Cingalese ; in Malaya, the rubber estate coolies include a few Malays, some Javanese, and a number of Chinese. In both countries it is very difficult for the planters to get as much labour as they require, in spite of the large immigrant population, and in order to make an estate pay, the man at the head of affairs, and all his assistants, must be so skilful at managing the natives that this particular estate is never the one to be short of hands.

Following a tapper on his round in a plantation is a very easy expedition compared with that journey we took with a seringueiro to see him get his morning's milk. The plantation tapper is surrounded by rubber-trees, they are never very far apart, and even when, for some reason or other, he has to pass one by without operating on it, the distance from his last stopping-place to his next is quite short. As a rule, only trees that measure at least 18 inches round at 3 feet from the ground are tapped, but some trees, even though

they belong to the grown-ups, have to be missed out for a time because they are doing a rest cure. Most of the trees in a grown-up section are, however, tapped daily, or on alternate days, for the greater part of the year, but the circumference of the trunk is so portioned off for operations that no part is retapped until old wounds have completely healed. Yet it is seldom that a tree is tapped at a higher distance than can be conveniently reached from the ground. The amount of milk yielded by a tree depends partly on its age, and partly on the state of its health. If a tree gives enough milk to make about ¾ pound of rubber the first year it is tapped, it is considered a good specimen. As it grows older, the yield should steadily increase. During 1909, one of the finest old Hevea trees in Ceylon, aged thirty-three, gave 15 gallons of milk, which contained 76 pounds of rubber.

At random we choose which coolie we will accompany on his round, and as we dog his footsteps we see a great deal of the outdoor life on a rubber plantation. At first, all our attention is taken up by watching how the one tapper does his work. The trees he visits already bear a herringbone, or half herringbone, design on the lower part of the trunk ; but it consists of alternate strips of almost bared wood and of bark, slanting down into the central line. With a tool something like a chisel, the coolie takes a shaving off each strip of bark, whereupon milk oozes out from the cuts, makes for the central channel, and trickles down into an enamel cup that awaits it at the base of the trunk.

Presently we are joined by another onlooker. Although he looks very much like a coolie, he is far and away the superior of the working-class mass. He

is a "kangany," an enterprising native who serves the planter in the double rôle of recruiting-sergeant and overseer. He makes periodical journeys to India to arrange for new batches of Tamils to emigrate to the rubber-growing districts; he brings his recruits to the particular district which is his headquarters, and sees them settled on this estate or that; and until he is again wanted to go off recruiting, he joins the staff of some plantation, and takes up the duties of teaching the new hands their work, and of seeing that a certain gang of the old ones are kept up to the mark.

Evidently the kangany overseers cannot be wholly relied on as teachers. For the one over yonder, who is showing a little Tamil girl how to tap a rubber-tree, has a white man standing by his side and superintending the lesson.

By about eleven o'clock most of the trees are ceasing for this day to yield milk. The coolies now make their rounds again for the purpose of collecting the day's supply. The contents of the little cups are poured into pails and cans, which, as they are filled, are taken to the factory. Some of the carriers balance their load on their head, others hang a vessel at either end of a pole, scale-fashion, and balance the burden on one shoulder.

CHAPTER XVII

WE VISIT A RAW-RUBBER FACTORY

It is time for us, too, to leave the plantation, since we want to see the milk made into rubber. A short walk brings us to one of the Linggi factories, which is the rubber-making centre for a neighbouring portion



C. W. Kerr & Co., Kandy, Ceylon

MAKING CRÊPE RUBBER ON A CEYLON ESTATE. *Page* 83

of the estate. Remembering that I promised to bring you to one of the finest rubber factories in the East, you are disappointed when you see only a medium-sized, one-story building, with a corrugated iron roof. In your mind's eye you immediately compare this building with some of the enormous factory piles you have seen in connection with other industries, and you think what a poor show it makes. Even when you go inside, there are no striking sights which immediately tempt you to alter your opinion.

"Seems to me," you say to yourselves, "there's nothing much to be seen here except dairy-pans and mangles. What a curious mixture!"

The explanation of your simple surroundings is that the process of manufacturing rubber is extremely simple, making no demands for huge machines such as a sugar-mill, for instance. I can assure you that in this factory you are going to see the process being carried out by the most scientific of present-day methods, with the assistance of the most up-to-date machinery. But in order that you may fully appreciate advanced methods of manufacture, let me first tell you how plantation rubber was generally made not so very long ago.

The milk was poured into small, round, shallow pans. To each panful a little acetic acid was added, to help the milk curdle, and the mixture was then stirred by fingers until it became a thick dough. Each little bit of dough was taken out of its pan, laid on a board, and a rolling-pin was passed over it to squeeze the water out. The result was a thin, round little "biscuit" of rubber. These biscuits were hung over a line, and when they were dry they were sent to market. Rubber

biscuits are still made on some plantations, where the supply of milk is too small, for the time being, to warrant the expense of putting up a factory and buying machinery. But the bulk of plantation rubber is now turned out in the form of crêpe or sheets such as we are now going to see made.

You notice that some of the milk which is brought into the factory is poured into those big pans which reminded you of a dairy, and some into oblong trays of enamel ware. In the pans, the milk is coagulated in bulk—that is to say, into big lumps—by the addition of acetic acid. The milk in each tray has to have a separate dose of the acid, so that each trayful will coagulate into a slab. To-day the machines are working on yesterday's milk-supply; the milk which has been brought in to-day will not be sufficiently coagulated for them to work on until to-morrow.

From some of the pans we see coolies lifting big lumps of a white substance that looks like very heavy dough. These are put into a machine which tears them into small pieces. A second machine, which has rollers covered with a diamond pattern, kneads the pieces together, and turns out a long strip of material which looks like tripe. When this has been passed two or three times through a third machine, which has smooth-faced rollers, a strip of "crêpe" rubber is ready to be taken to the drying-room or to the smoking-room.

The slabs taken out of the trays are passed through a machine which has smooth, copper rollers. The compact, oblong pieces of rubber which are the result of this method of preparation are called "sheets." Some factories send smooth-surfaced sheets to market,



M. S. Nakajima, Kuala Lumpur

FINISHED FOR THE DAY. *Page* 85

Notice the cups turned upside down on trees to drain, after washing

others stamp their sheets top and bottom with a deep diamond pattern, to provide for ventilation when they are packed. Here we see the sheets, after they leave the smooth rollers, passed through a machine that has a diamond pattern deeply indented on its rollers.

All the rubber we see leaving the machine is white. We go now to the drying-room, and there we find sheets and crêpe in all shades of yellow, hanging over the wooden rails that stretch from end to end and side to side of the apartment. The material turns yellow as it dries ; sometimes it takes on a pale lemon tint, somtimes a rich, deep amber, or golden hue. The quality of rubber does not depend on the shade of the material, but if any dirt has been allowed to get into the milk, the light-hued strips tell tales more plainly than the dark ones. The rubber which is finished off in the drying-room is uncured.

We are very anxious to see the smoking-room, for we know that every planter's great ambition is to turn out of his factory rubber which is so thoroughly well cured that it can compete with the exceptionally well cured Brazilian Para. We are even more anxious to get out of that room. After a very few minutes we feel that not for another moment shall we be able to breathe in such an atmosphere. On the ground floor beneath us a big fire is consuming cocoanut shells, and belching forth clouds of smoke. We cannot actually see the smoke, but, like all the rubber around us, we are getting the full " benefit " of it as it finds its way through a double ceiling of perforated zinc. The smoke is turning most of the rubber in this room brown ; some thin crêpe, which has been here nearly three weeks, and some thick crêpe, called " blanket," which

has been here over a month, are very dark brown. You are quite right in thinking they must be well baked. They will soon be taken from their present quarters, packed up and sent to market; and they are so well cured, and are of such excellent quality, that they will probably fetch a higher price per pound than the best quality wild Para.

It is in this room that you happen to make your first acquaintance with some crêpe rubber of a greyish hue. It is made from scraps, which are collected by the tappers from trees, cups, and cans, after they have taken the day's milk to the factory. The scraps are washed as clean as it is possible to get them, and then put through the crêping machines. Plantation scrap is far superior in quality to wild scrap.

CHAPTER XVIII

RUBBER GOODS

In England, the chief markets for raw rubber, wild and plantation, are London and Liverpool. The other principal importers are the United States, France, Germany, Belgium, and Russia. The making of rubber goods is an important industry in all these countries which are such good customers for the raw material.

Rubber passes through many hands during its long journey to market. First it has to be sent to the chief port of the district where it is obtained. In Brazil this means a long journey by river direct to Para, or to Para via Manaos with a break of journey at that busy, up-country river port. Some of the Brazilian rubber has to be taken 250 miles in open boats, along

a course that contains many stretches of dangerous rapids, and is blocked by a number of falls. It then has to go on by steamer for 500 miles before it gets to Para. And some of the Brazilian pelles are made into rafts, which are taken downstream to the nearest point where the pelles can be transferred to a steamer. In Ceylon, the principal distribution depôt is the port of Colombo ; in Malaya, most of the rubber leaves home via Singapore or Port Swettenham. Plantation rubber travels in packing-cases to local ports by rail, by river in little Noah's Ark boats thatched with palm-leaves, or by road in bullock-carts. Both wild and plantation rubber get a break of journey at some local port, where there are warehouses in which the material can be stored in order that it may be submitted to a searching examination. It has to be weighed, sampled, and sorted according to quality. Plantation rubber can be very easily sampled and graded, because its form is such that it can be easily handled and seen through. But much of the wild product is sent to market in bulky masses. It is hard work cutting through the samples which are selected to undergo the test of seeing whether they are as good through and through as they are on the surface, or whether they contain any makeweight, such as sand or rope.

When the time comes for the raw material to continue its journey to market, it is put aboard an ocean-going steamer, which takes it overseas to the port where it is to be sold. Here again it is received into a warehouse. Once more it is weighed and sampled. The samples are sent to manufacturers, with a catalogue, stating that so many pounds of rubber, corresponding to such or such a sample, will be sold by

auction on a certain date at a certain market. The rubber itself, in its packing-cases or sackcloth covering, is taken down to vaults, where it is stored until it is claimed by whoever buys it at the auction. Vaults are used as storage quarters for raw rubber in order that the material may be kept in an even temperature ; for not until that material is within a rubber goods factory is it made climate-proof by vulcanization.

We can stand outside any rubber goods factory and watch the material being taken within its doors ; that is to say, we can see big boxes and bulky canvas packages being taken in, and we know now that their contents consist of rubber pelles, crêpe, sheets, biscuits, or blocks, which were once white milk, and are now a solid material that is yellow, brown, grey or black in colour.

To see what comes out of such factories we need only look around us at the common objects of everyday life. In the streets there are motor-cars, taxicabs, omnibuses, and bicycles running on wheels that have rubber tyres. On a wet day most of the people outdoors are wearing mackintoshes, whilst some of them are further protected against the rain by galoshes ; even on a fine day, rubber is worn a very great deal outdoors in the form of boot-and-shoe-heel protectors. In the house there are rubber washers on the taps, rubber rings on the stoppers of the ginger-beer bottles within the pantry, a teapot on the kitchen dresser has been mended with a rubber spout, and the children are playing with rubber balls, dolls, and toy balloons. In the hospital the doctors use surgical instruments that have important parts made of rubber, and many of the patients are provided with rubber necessaries, such as elastic



R. B. Lodge, Enfield

SAMPLING BOLIVIAN RUBBER AT BULL WHARF, LONDON. *Page* 86

stockings, made of rubber thread, for bad legs, and false teeth on a plate of vulcanite, which is chiefly rubber. Travellers take rubber baths and rubber cushions about with them. Golfers play with rubber balls. Machinery would be at a standstill without rubber belting. What an inconvenient world this must have been to live in less than a hundred years ago, when anything made of rubber was a novelty! And there is no telling how much more comfortable and convenient rubber may make life in days not so very long ahead. For it is a most active assistant of progress, so much so that it is now helping man to fly.

Knowing the form in which rubber goes into the manufacturer's possession, and a few, at any rate, of the many forms in which it next makes a public appearance, we are naturally very anxious to learn how such transformations take place. It is impossible for me to take you over a rubber goods factory, much as I should like to do so. All such establishments keep very strictly to the rule of "No admittance except on business." There are secrets to be hidden, not from the public, but from a rival manufacturer. You must quite understand that no offence is meant to you personally when no exception can be made in anyone's favour in case some rival's friend should slip through.

You need not be very disappointed—enough is known of the way rubber goods are made to satisfy much of your curiosity.

The manufacturer must always bear in mind that he must fulfil two important conditions: first, his goods must serve the purpose for which they are intended, and next, the price which customers will pay has to be taken into consideration, with the idea of producing

the best wearing article that can be made for the money.

According to the use to which rubber is to be put, it has to be mixed with certain other materials, to make a material that is neither too heavy nor too light, too hard nor too soft, too tough nor too elastic, to fulfil its purpose. And according to the price at which the goods are to be sold, certain other materials must be mixed with the rubber. It is with regard to the proportions in which such mixings are made that the manufacturers have secrets of their own which they specially want to guard. The compounding materials consist of such things as zinc oxide, white lead, and magnesia. Always to the "dough," "mixing," or "batch," as the compound is called, some sulphur is added to bring about vulcanization. A colouring ingredient is also put into some of the dough, according to the taste and fancy of customers for whom goods are going to be made. The dough is worked smooth, and is then put into moulds shaped like the required articles, or built up into shape and form. The goods are generally vulcanized by steam heat. Much skill, together with great care and patience, goes to the making of all rubber goods; and when such goods have to be canvas backed, or to be made of a material that is bodily a mixture of thread and rubber, the process of manufacture calls for particularly good workmanship.

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